UNIVERSITY OF ALBERTA

CANADIAN AGRICULTURAL MARKETING CO-OPERATIVES: DOES REGULATORY ENVIRONMENT AFFECT PERFORMANCE?

BY

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ABSTRACT

This thesis studies the performance of marketing co-operatives, examining the potential effects of supply management on the co-operatives operating in supply management sectors and those not operating under it. The data used is unbalanced panel of financial data from 1984 – 2001 from the annual survey of agribusiness co-operatives conducted by the Canadian Co-operatives Secretariat, Government of Canada.

Financial ratio analysis was used to estimate the effects of membership size, firm size, prices of input, time trends, market concentration, market share of a co-operative and financial leverage on profit margin and current ratio of individual co-operatives. Profit function and efficiency estimations were also used to estimate the technical and allocative efficiencies of the various co-operatives.

Supply-managed co-operatives were found to have comparable financial ratios to non supply-managed co-operatives. Both supply-managed and non supply-managed co-operatives were concluded to be technically and allocatively inefficient with the former being more responsive to efficiency improvements.

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Finally, I dedicate this thesis to my husband, Selasi for his unflinching love, support, encouragement and above all, patience throughout my study.

TABLE OF CONTENTS

Page

1.0 CHAPTER 1: INTRODUCTION 1

1.1 TRENDS IN AGRICULTURAL MARKETING CO-OPERATIVES 4

1.2 SIGNIFICANCE OF THE STUDY 11

1.3 OBJECTIVES OF THE STUDY 13

1.4 ORGANIZATION OF THE THESIS 13

2.0 CHAPTER 2: LITERATURE REVIEW 15

2.1 INTRODUCTION 15

2.2 THEORY OF CO-OPERATIVES 16

2.3 ECONOMICS OF MARKETING CO-OPERATIVES 20

2.3.1 Marketing Co-operative in a competitive market 23

2.3.2 Marketing Co-operative As A Monopsonist 25

2.3.3 Effect of regulation on marketing strategy of marketing co-operatives 28

2.4 STUDIES ON REGULATION AND PERFORMANCE 30

2.5 FIRM PERFORMANCE 35

2.5.1 Implications of Co-operative Behaviour on Financial Performance 37

2.5.2 Previous Studies on Firm Performance Measurement 38

2.5.3 Financial Ratios Studies 46

2.5.4 Economic Efficiency Studies 48

2.5.5 Previous Studies on Performance Measurement of Co-operatives 53

2.6 SUPPLY MANAGEMENT EFFECTS 62

2.6.1 Canadian Price Trends 64

2.6.2 Quota Value 65

2.6.3 Effect of Supply Management on Producers and Consumers 67

2.6.4 Effect of Supply Management on Processors 68

2.7 SUMMARY OF THE CHAPTER 72

3.0 CHAPTER 3: CONCEPTUAL AND THEORETICAL FRAMEWORK 75

3.1 INTRODUCTION 75

3.2 FINANCIAL RATIO ANALYSIS 76

3.2.1 The Conceptual Model of the Financial Ratio Analysis 84

3.2.2 Methods of the Financial Ratio Analysis 86

3.2.3 Measures 87

3.2.4 Summary of Financial Ratio Analysis 94

3.3 ESTIMATION OF CO-OPERATIVES' ECONOMIC EFFICIENCY 94

3.3.1 Theoretical Foundations of the Profit Function 98

3.3.2 Application of the Profit Function to Economic Efficiency 101

3.3.3 Allocative Efficiency 101

3.3.4 Technical Efficiency 102

3.3.5 Incorporating Technical and Allocative Efficiency into the Profit Function 102

3.3.6 Objective of Co-operatives 104

3.3.7 Choice of Functional Forms 105

3.3.8 The Translog Model 106

3.3.9 Farm Level Supply Equation 109

3.3.10 Estimation of Profit Maximization Function For Co-operatives 111

3.4 SUMMARY OF THE CHAPTER 114

4.0 CHAPTER 4: FINANCIAL RATIO ANALYSIS RESULTS AND DISCUSSION 115

4.1 INTRODUCTION 115

4.2 DESCRIPTION AND ANALYSIS OF THE DATA SET 115

4.3 FINANCIAL RATIOS RESULTS 118

4.3.1 Profit Margin Results 137

4.3.2 Current Ratio Results 153

4.4 SUMMARY OF FINANCIAL RATIO RESULTS 157

5.0 CHAPTER FIVE: PROFIT FUNCTION AND EFFICIENCY ESTIMATION RESULTS AND DISCUSSION 159

5.1 INTRODUCTION 159

5.2 PROFIT FUNCTION AND EFFICIENCY ESTIMATION 159

5.2.1 The Likelihood Ratio Test 161

5.2.2 Empirical Results 162

5.3 RESULTS OF HYPOTHESIS TESTING 174

5.4 ESTIMATES OF PRICE ELASTICITIES OF INPUT DEMAND 178

5.5 ESTIMATED EFFECTS OF POTENTIAL EFFICIENCY IMPROVEMENTS 180

5.6 SUMMARY OF THE CHAPTER 191

6.0 CHAPTER SIX: SUMMARY, CONCLUSIONS AND LIMITATIONS ... 192

6.1 INTRODUCTION 192

6.2 SUMMARY OF THE THESIS 192

6.3 CONCLUSIONS 195

6.4 LIMITATIONS 197

6.5 RECOMMENDATIONS FOR FUTURE RESEARCH 198

REFERENCE LIST 199

APPENDIX TO CHAPTER TWO 215

APPENDIX TO CHAPTER THREE 223

APPENDIX TO CHAPTER FOUR 239

APPENDIX TO CHAPTER FIVE 250

LIST OF TABLES

Table 1: Total Revenues of Agricultural Co-operatives Reporting To Canadian Co-operatives Secretariat ($M), 1984 - 2002 3
Table 2: Marketing Revenues ($M) by Agricultural Co-operatives Reporting by Commodity, 1984 – 2002. 5
Table 3: Co-operative Market Share (%) in Farm Commodity Sales By Co-operatives Reporting (1984 – 2002) 5
Table 4: Corporate Level 42
Table 5: Business Unit Level 42
Table 6: Market Share of the Various Marketing Co-operatives in the Industry (1984 – 2001). 89
Table 7: Herfindahl Indices in the Various Industries (1984 – 2001) 91
Table 8: Kruskal-Wallis Test For Financial Ratios Of Co-operatives Across All The Various Sub-Sectors 121
Table 9: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy and Poultry and Egg Sub-Sectors (Supply-Managed Sub-Sectors) 121
Table 10: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Fruit And Vegetable, Honey And Maple, Grain And Oilseed And Livestock Sub-Sectors (Non Supply-Managed Sub-Sectors). 122
Table 11: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Honey and Maple Sub-Sectors 122
Table 12: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Fruits and Vegetable Sub-Sectors 122
Table 13: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Grain and Oilseed Sub-Sectors 123
Table 14: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Livestock Sub-Sectors 123
Table 15: Kruskal-Wallis Test for Financial Ratios of Individual Dairy Co-operatives 124
Table 16: Kruskal-Wallis Test for Financial Ratios of Individual Poultry and Egg Co-operatives 124

Table 17: Kruskal-Wallis Test for Financial Ratios of Individual Fruit and Vegetable Co-operatives 124
Table 18: Kruskal-Wallis Test for Financial Ratios of Individual Honey and Maple Co-operatives 125
Table 19: Kruskal-Wallis Test for Financial Ratios of Individual Grain and Oilseed Co-operatives 125
Table 20: Kruskal-Wallis Test for Financial Ratios of Individual Livestock Co-operatives 125
Table 21: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Dairy Sub-sector 139
Table 22: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Poultry And Egg And Honey And Maple Sub-sectors 140
Table 23: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Fruit And Vegetable Sub-sector 140
Table 24: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Grain And Oilseed Sub-sector 141
Table 25: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Livestock Sub-sector 142
Table 26: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Dairy Sub-sector 149
Table 27: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Poultry And Egg And Honey And Maple Sub-sectors 150
Table 28: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Fruit And Vegetable Sub-sector 150
Table 29: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Grain And Oilseed Sub-sector 151
Table 30: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Livestock Sub-sector 152
Table 31: Test Of Hypotheses And The Implied Parameter Restrictions 161
Table 32: Parameter Estimates of Unrestricted and Restricted Models for Medium Dairy Co-operatives [F0478 (1) F0559 (2) F1322 (3)] 163

Table 33: Parameter Estimates of Unrestricted and Restricted Models for Small Dairy Co-operatives 164
Table 34:Parameter Estimates of Unrestricted and Restricted Models for Small Dairy Co-operatives 165
Table 35: Parameter Estimates of Unrestricted and Restricted Models for Large Dairy Co-operatives 166
Table 36: Parameter Estimates of Unrestricted and Restricted Models for Poultry Co-operatives 167
Table 37: Parameter Estimates of Unrestricted and Restricted Models for Fruits and Vegetables Co-operatives [A0066 (13) A0099 (14) E0333 (15)] 168
Table 38: Parameter Estimates of Unrestricted and Restricted Models for Honey and Maple Co-operatives [B0085 (16) D0145 (17)] 169
Table 39: Parameter Estimates of Unrestricted and Restricted Models for Grains and Oilseeds Co-operatives [E0192 (18) C0001 (19) E0234 (20)] 170
Table 40: Parameter Estimates of Unrestricted and Restricted Models for Livestock Co-operatives 171
Table 41: Hypothesis Testing Results Medium Dairy Co-operatives [F0478 (1) 174
Table 42: Hypothesis Testing Results Small Dairy Co-operatives [E0296 (4) 174
Table 43: Hypothesis Testing Results Small Dairy Co-operatives [A0205(7) 175
Table 44: Hypothesis Testing Results Large Dairy Co-operatives [F0267 (8) E0152 .. 175
Table 45: Hypothesis Testing Results for Poultry and Eggs Co-operatives 175
Table 46: Hypothesis Testing Results for Fruits and Vegetables Co-operatives 176
Table 47: Hypothesis Testing Results for Honey and Maple Co-operatives 176
Table 48: Hypothesis Testing Results for Grains and Oilseeds Co-operatives [E0192 . 176
Table 49: Hypothesis Testing Results for Livestock Co-operatives [A0197 (21) 177
Table 50: Simulation Model For Supply-Managed And Non Supply-Managed Sub-Sectors 186
Table 51: Table Showing The Simulations Of Effects Of Efficiency Changes On The Profit, Producer Surplus, Member Welfare And Quantity Of Produce Used By The Various Sub-Sectors 188

Table 52: Table Showing The Percent Increase In The Profit, Producer Surplus, Member Welfare And Quantity Of Produce used By The Various Sub-Sectors 189
Table 53: Summary of Firm Performance Studies 215
Table 54: Table Showing Total Assets Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001) 223
Table 55: Table Showing Total Assets Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 – 2001) 223
Table 56: Table Showing Total Assets Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001)..... 224
Table 57: Table Showing Total Assets Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 – 2001)..... 2255
Table 58: Table Showing Total Assets Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 – 2001)..... 225
Table 59: Table Showing Total Assets Of Individual Co-operatives In The Livestock Sub-sector (1984 – 2001)..... 226
Table 60: Table Showing Market Shares Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001) 226
Table 61: Table Showing Market Shares Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 – 2001) 227
Table 62: Table Showing Market Shares Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001) (%)..... 228
Table 63: Table Showing Market Shares Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 – 2001) (%)..... 228
Table 64: Table Showing Market Shares Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 – 2001) (%)..... 229
Table 65: Table Showing Market Shares Of Individual Co-operatives In The Livestock Sub-sector (1984 – 2001) (%)..... 230
Table 66: Table Showing Membership Size Of Individual Co-operatives In The Dairy Sub-sector (1984 -2001) 230
Table 67: Table Showing Membership Size Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 -2001) 231

Table 68: Table Showing Membership Size Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 -2001) 232
Table 69: Table Showing Membership Size Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 -2001) 232
Table 70: Table Showing Membership Size Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 -2001) 233
Table 71: Table Showing Membership Size Of Individual Co-operatives In The Livestock Sub-sector (1984 -2001) 233
Table 72: Table Showing Debt Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001) 234
Table 73: Table Showing Debt Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 – 2001) 235
Table 74: Table Showing Debt Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001) 235
Table 75: Table Showing Debt Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 – 2001) 236
Table 76: Table Showing Debt Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 – 2001) 236
Table 77: Table Showing Debt Of Individual Co-operatives In The Livestock Sub-sector (1984 – 2001) 237
Table 78: Total Value of Sales in the Various Sectors (1984 – 2001) ('$) 238
Table 79: Farm Prices of Produce used in Estimations (1984 – 2001) 239
Table 80: Retail Prices of Produce used in Estimations (1984 – 2001) 240
Table 81: Descriptive Statistics of the Individual Co-operatives used in the study 241
Table 82: Table Showing Current Ratios Of Individual Co-operatives In The Dairy Sub-sectors (1984 – 2001) 243
Table 83: Table Showing Current Ratios Of Individual Co-operatives In The Poultry and Egg and Honey and Maple Sub-sectors (1984 – 2001 243
Table 84: Table Showing Current Ratios Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001) 244

Table 85: Table Showing Current Ratios Of Individual Co-operatives In The Grain and Oilseed and Livestock Sub-sectors (1984 – 2001) 245
Table 86: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001)..... 245
Table 87: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Poultry and Egg and Honey and Maple Sub-sectors (1984 – 2001)..... 246
Table 88: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001 246
Table 89: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Grain and Oilseed and Livestock Sub-sectors (1984 – 2001)..... 247
Table 90: Table Showing Profit Margin Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001) 247
Table 91: Table Showing Profit Margin Of Individual Co-operatives In The Poultry and Egg and Honey and Maple Sub-sectors (1984 – 2001) 248
Table 92: Table Showing Profit Margin Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001)..... 248
Table 93: Table Showing Profit Margin of Individual Co-operatives In The Grain and Oilseed and Livestock Sub-sectors (1984 – 2001) 249
Table 94: Category of Individual Dairy and Fruits and Vegetables Co-operatives..... 250
Table 95: Category of Individual Grains and Oilseeds and Livestock Co-operatives.... 250
Table 96: Category of Individual Poultry and Eggs and Honey and Maple Co-..... 251
Table 97: Input Demand Elasticity Estimates for Medium Dairy Co-operatives..... 253
Table 98: Input Demand Elasticity Estimates for Large Dairy Co-operatives 253
Table 99: Input Demand Elasticity Estimates for Small Dairy Co-operatives 254
Table 100: Input Demand Elasticity Estimates for Small Dairy Co-operatives 254
Table 101: Input Demand Elasticity Estimates for Poultry and Eggs Co-operatives 254
Table 102: Input Demand Elasticity Estimates for Fruit and Vegetable Co-operatives. 255
Table 103: Input Demand Elasticity Estimates for Honey and Maple Co-operatives.... 255
Table 104: Input Demand Elasticity Estimates for Grain and Oilseed Co-operatives ... 255
Table 105: Input Demand Elasticity Estimates for Livestock Co-operatives..... 256
Table 106: Results Of Farm Level Supply Estimations For The Various Sub-sectors...256

LIST OF FIGURES

Figure 1: Total Revenues of Agricultural Co-operatives Reporting To Canadian Co-operatives Secretariat ($M), 1984 - 2002 2
Figure 2: Marketing Co-operative in a Perfectly Competitive Market 24
Figure 3: Co-operative and IOF as a Monopsonist in a Market 26
Figure 4: Co-operative in a Regulated Market 28
Figure 5: Analyses of Performance Dimension (Source: (Scherer, 1980)) 37
Figure 6: Proposed Model of Variables that Affect Firm Performance 86
Figure 7: A Graph Comparing The Trends in Current Ratios Of The Various Sub-Sector Groups With The Total Sector (1984 – 2001) 126
Figure 8: A Graph Comparing The Trends in Debt-To-Equity Ratios Of The Various Sub-Sector Groups With The Total Sector (1984 – 2001) 127
Figure 9: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Dairy Sub-Sector (1984 – 2001) 127
Figure 10: A Graph Showing The Trend In Current Ratio Of Individual Co-operatives In The Poultry and Egg Sub-Sector (1984 – 2001) 128
Figure 11: A Graph Showing The Trend In Current Ratio Of Individual Co-operatives In The Honey And Maple Sub-Sector (1984 – 2001) 128
Figure 12: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Fruit And Vegetable Sub-Sector (1984 – 2001) 129
Figure 13: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Grain And Oilseed Sub-Sector (1984 – 2001) 129
Figure 14: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Livestock Sub-Sector (1984 – 2001) 130
Figure 15: A Graph Showing The Trend In Debt-To-Equity Ratio of Individual Co-operatives In The Dairy Sub-Sector (1984 – 2001) 130
Figure 16: A Graph Showing The Trend In Debt-To-Equity Ratio of Individual Co-operatives In The Poultry and Egg Sub-Sector (1984 – 2001) 131
Figure 17: A Graph Showing The Trend In Debt-To-Equity Ratio Of Individual Co-operatives In The Honey And Maple Sub-Sector (1984 – 2001) 131

Figure 18: A Graph Showing The Trend In Debt-To-Equity Ratio Of Individual Co-operatives In The Fruit And Vegetable Sub-Sector (1984 – 2001) 132
Figure 19: A Graph Showing The Trend In Debt-To-Equity Ratio Of Individual Co-operatives In The Grain And Oilseed Sub-Sector (1984 – 2001) 132
Figure 20: A Graph Showing The Trend In Debt-To-Equity Ratio of Individual Co-operatives In The Livestock Sub-Sector (1984 – 2001) 133
Figure 21: A Graph Showing The Trend In Profit Margin of Individual Co- operatives In The Dairy Sub-Sector (1984 – 2001) 133
Figure 22: A Graph Showing The Trend In Profit Margin Of Individual Co- operatives In The Poultry And Egg Sub-Sector (1984 – 2001) 134
Figure 23: A Graph Showing The Trend In Profit Margin of Individual Co- operatives In The Honey And Maple Sub-Sector (1984 – 2001) 134
Figure 24: A Graph Showing The Trend In Profit Margin Of Individual Co- operatives In The Fruit And Vegetable Sub-Sector (1984 – 2001) 135
Figure 25: A Graph Showing The Trend In Profit Margin Of Individual Co- operatives In The Grain And Oilseed Sub-Sector (1984 – 2001) 135
Figure 26: A Graph Showing The Trend In Profit Margin Of Individual Co- operatives In The Livestock Sub-Sector (1984 – 2001) 136

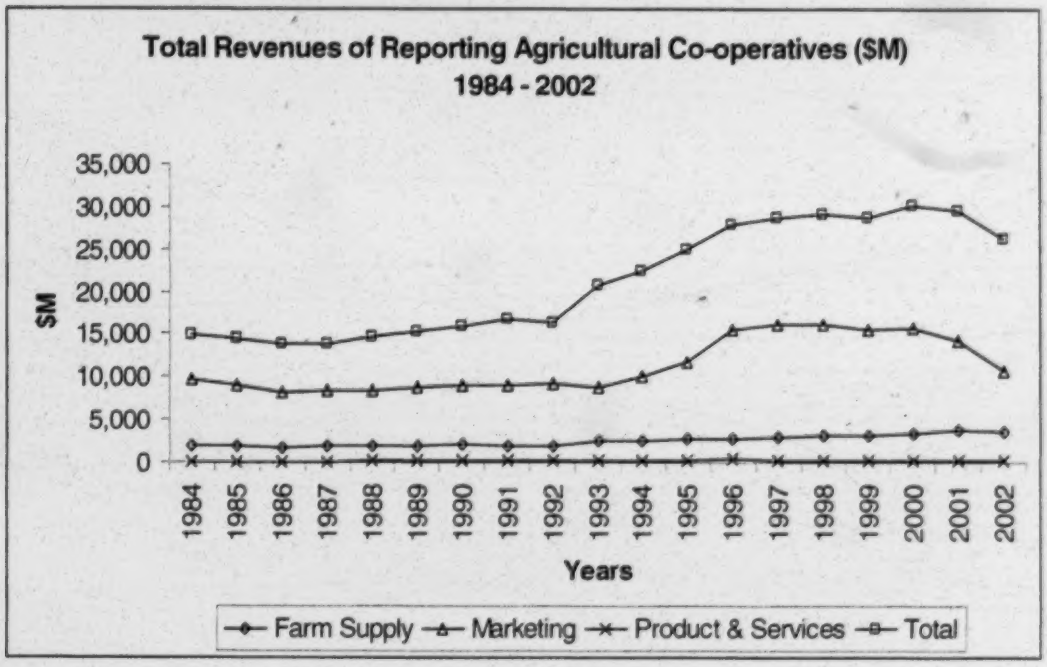
1.0 CHAPTER 1: INTRODUCTION

Co-operatives play an important economic role in Canadian agriculture, as indicated by their substantial asset ownership and market share. The agribusiness co-operative sector is a significant element of Canadian business sectors in terms of cash receipts ($26.1 billion in 2002), assets ($16.8 billion in 2002), value-added ($1.2 billion in 2002), employment (83,000 people in 2002), and membership (5.1 million people in 2002) (Co-operatives Secretariat, 2004). Co-operatives play a crucial role in farm supply and in the processing and marketing of grains and oilseeds, dairy products, poultry, fruits, vegetables, livestock, honey and maple products.

Agricultural marketing co-operatives are a distinct sector of co-operatives. Agricultural marketing co-operatives are involved in processing and value adding for farm products (Co-operatives Secretariat, 2004). In 2003, three agricultural marketing co-operatives, Co-operative Fédérée de Québec (that processes meat and poultry), Saskatchewan Wheat Pool (in grains and oilseeds), Agropur (in dairy), were among the top five co-operatives in the top 50 Canadian co-operatives (in terms of sales). These three marketing co-operatives contributed approximately 34% of the total revenues of agricultural co-operatives (Co-operatives Secretariat, 2004). Examining the performance of marketing co-operatives is important because of the contribution marketing co-operatives have made to agricultural co-operatives in particular and to the economy in general. In 2002, employment in agricultural marketing co-operatives represented approximately 80% of total employment by agricultural co-operatives. Also in 2002, marketing co-operatives accounted for the majority (about 80%) of agricultural co-

operative revenue (Figure 1), the greatest revenue coming from dairy and grains and oilseeds co-operatives. Marketing co-operatives reported a decline in total revenue from $16 billion in 1997 to $10 billion in 2002 (Table 1) cited to be as a result of large losses in the grain and oilseed and dairy sectors, (these include, the drop in dairy co-operative revenue due to the reorganization of Agrifoods International, a decline in grain and oilseed revenue due to the demutualization of Agricore and the decline in the volume of business of Saskatchewan Wheat Pool due to a prolonged drought in Western Canada) (Gurung and McCagg, 2005).

Figure 1: Total Revenues of Agricultural Co-operatives Reporting To Canadian Co-operatives Secretariat ($M), 1984 - 2002



Source: Co-operatives in Canada (1984-2002) publications by Canadian Co-operatives Secretariat.

Table 1: Total Revenues of Agricultural Co-operatives Reporting To Canadian Co-operatives Secretariat ($M), 1984 - 2002

Year	Farm Supply	Marketing	Product & Service	Total Agricultural Co-ops
1984	1,828	9,672.6	67	14,937.4
1985	1,858	9,088.3	76	14,483.5
1986	1,658	8,209	89	13,734.3
1987	1,789	8,296	90	13,762.3
1988	1,858.5	8,405.8	107	14,621.7
1989	1,947.4	8,722.7	122	15,281.2
1990	2,011.5	8,981.7	148	15,932.5
1991	1,950	8,928	263	16,693.4
1992	1,915.5	9,167.4	276	16,369.9
1993	2,567.0	8,806.4	199	20,658.8
1994	2,588.4	10,136.8	220	22,397.8
1995	2,791.7	11,817.6	247	24,845.7
1996	2,813	15,493	455	27,844.7
1997	3,004	16,141.2	227	28,776.4
1998	3,050	16,203	233	29,039.4
1999	3,108	15,437	258	28,638.2
2000	3,306	15,750	263	30,149.8
2001	3,696	14,238	215	29,451.0
2002	3,484	10,608	221	26,094.7

Source: Co-operatives in Canada (1984-2002) publications by Canadian Co-operatives Secretariat.

Over the past 20 years, many marketing co-operatives have changed structure (i.e. gone out of business, changed ownership, merged, or become publicly listed). Dairy marketing co-operatives from British Columbia and Alberta merged to form Agrifoods International Co-operative Ltd. (commonly known as Dairyworld) in 1992 (The Globe and Mail, 1992). In subsequent years, dairy co-operatives in Saskatchewan, Manitoba and the Maritimes merged with Agrifoods International. Then in early 2001, Saputo Inc. a private firm, acquired certain joint venture interests of Agrifoods International Co-operative Ltd. (The Globe and Mail, 2001). Although Agrifoods International remains in operation, it is at a much smaller scale than before the sale. Agropur, a dairy co-operative in Quebec merged with Lactel, a private firm, in 2000 (Canada NewsWire, 2000). In 1993, United Grain Growers (UGG) became a partially publicly traded enterprise.

Alberta Wheat Pool and Manitoba Wheat Pool merged to form Agricore in 1998. Agricore ultimately merged with United Grain Growers (UGG) to become Agricore United, an investor owned firm in November 2001 (United Grain Growers Limited, 2004). About 45% of Agricore United is owned by Archer Daniel Midlands (ADM). Saskatchewan Wheat Pool became a partially publicly traded enterprise in 1996 (CBC Saskatchewan, 2003). As of February 2005, Saskatchewan Wheat Pool stopped operating as a co-operative (CBC, Saskatchewan, 2005). In the process of consolidation, the agricultural co-operative sector has lost around 45,000 active members (Gurung and McCagg, 2005).

1.1 Trends in Agricultural Marketing Co-operatives

Agricultural marketing co-operatives increased in number from 118 in 1986 to 156 in 2002 (Co-operatives Secretariat, 2004). Given the variety of sectors of marketing co-operatives, it is worthwhile to look at the trends in these sectors and to see how they have been faring over the years. From Table 2, it can be seen that there tended to be an increase in revenue for all the sectors over the years. However, when we look at the dairy sector, we notice a significant decrease in revenue from 2000 to 2002 reflecting the privatization noted above. On the other hand, the revenue from the poultry and eggs sector has consistently increased over the years. Given that dairy and poultry and egg each operate under supply management, it is of interest to ask what role has the regulatory environment played in the trends of these two sectors?

Table 2: Marketing Revenues ($M) by Agricultural Co-operatives Reporting by Commodity, 1984 – 2002.

Year	Dairy	Poultry & Eggs	Fruits & Vegetables	Honey & Maple	Grains & Oilseeds	Livestock	Other Marketing
1984	2355.4	288.4	191.7	28	5,118.1	459.7	41.4
1985	2,424.6	319.8	203.6	30.2	4,262.2	457.3	43.9
1986	2,449.4	325	215.1	29.6	3499.3	392	42.4
1987	2,566.9	356.2	220.1	30.4	3417.4	522.5	38.5
1988	2,652.3	345.3	230.8	31	3256	602.1	43.6
1989	2,607.3	372.9	246.4	32	3545.1	554.5	45.8
1990	2,237.4	405.1	249.3	31.1	3895.5	542.8	50
1991	2,831.3	447.2	247.4	30.3	3834.6	587.9	57.3
1992	2,832	456.7	282.9	30.2	3385.6	600	54
1993	3,052.8	535.6	277.9	34.3	3072.5	691.8	63.2
1994	3,158.7	570.3	258.4	35.4	4173.6	652.2	55
1995	3,216.5	574.2	260.8	44.7	5838.6	442.5	73.1
1996	3,294.3	1,023.1	275.9	34.2	7016.4	1182.5	123
1997	3,566.4	1,082.6	250.5	50.7	7030.6	1327.2	176.7
1998	3,788.1	1,125.8	242.7	57	6,504	1,464	89
1999	4,002.7	1,117.6	204.3	60.3	5,866	1,677	86
2000	4,340.4	1,248.9	218	73.3	5,470	1,554	72
2001	3,172.4	1,386.2	202	77	4,214	1,870	62
2002	3,164	1,451	222	86	1,843	1,838	64

Source: Co-operatives in Canada (1984-2002) publications by Canadian Co-operatives Secretariat.

Table 3: Co-operative Market Share (%) in Farm Commodity Sales By Co-operatives Reporting (1984 – 2002)

Years	Dairy	Poultry & Eggs	Fruit & Vegetables	Honey & Maple	Grains & Oilseeds	Livestock
1984	57	31	18	23	74	16
1985	58	34	21	23	74	16
1986	57	34	22	20	70	15
1987	58	35	19	23	72	18
1988	57	32	16	26	73	20
1989	56	35	17	26	75	19
1990	46	36	15	29	75	20
1991	59	39	14	23	74	23
1992	60	48	15	23	71	21
1993	63	47	18	29	55	21
1994	61	47	16	23	52	22
1995	57	47	15	31	55	18
1996	59	54	25	15	54	20
1997	62	47	15	22	54	18
1998	64	47	17	20	51	20
1999	66	48	12	21	49	19
2000	59	49	6	27	47	11
2001	42	49	8	28	45	14
2002	42	52	6	29	30	15

Source: Co-operatives in Canada (1984-2002) publications by Canadian Co-operatives Secretariat.

From Table 3 above, it is seen that the market share of agricultural marketing co-operatives has tended to be larger in three sectors: poultry and eggs, dairy and grains and oilseeds. The grains and oilseeds sector used to have the highest market share until the early 1990s when the dairy sector became larger. By 2001, the poultry and eggs sector had the largest co-operative market share.

The contribution of co-operatives to the economy is evident, however, according to Hailu et al. (2003), the 1980's and 1990's brought several threats and opportunities to the sector that were introduced through (i) structural changes in international markets and food retailing sectors, (ii) international trade agreements, (iii) declining margins, (iv) changes in domestic policies such as those around Western grain transportation issues (Goddard, 2002) (v) the world-wide trend of agro-industrialisation (Barry, 1995) (vi) decreasing barriers to capital transfers, and (vii) the increasing importance of the stock company (Sven, 1992). The potential changes (technological and policy environments) facing the global and Canadian agribusiness sectors, competitiveness in the co-operative sector of processing and marketing farm products, and in providing agricultural supplies and services related to farm production and marketing may be increasingly important in determining both future performance of individual agribusiness co-operatives, and long-term viability for the co-operative sector.

One of the peculiar characteristics of the Canadian agribusiness co-operative sector is the regulatory environment under which some of the marketing co-operatives operate. One policy instrument is the Canadian Wheat Board. The supply management program in Canada which is used to regulate price and quantity is another feature of some co-operatives. Supply management practises a centralized control over the quantity and

price of one or more commodities produced by a known group of producers and sold to a particular market in a given period (Lane and Menzie, 1987). Supply management is a long-standing policy in Canadian agriculture and it formally became part of the national agricultural policy in the 1970's (Veeman, 1987). Supply management applies to dairy products, chicken, turkey and eggs. There are four main groups of poultry and egg producers that have established national marketing agencies under the supervision of the National Farm Products Council to regulate the production and marketing of poultry and eggs (National Farm Products Council, 2004). These national marketing agencies are: (i) Canadian Egg Marketing Agency (CEMA), (ii) Canadian Turkey Marketing Agency (CTMA), (iii) Chicken Farmers of Canada (CFC) and (iv) Canadian Broiler Hatching Egg Marketing Agency (CBHEMA) (National Farm Products Council, 2004). The stated goal of these agencies is to control the supply of poultry and eggs in Canada so that price and income stability can be achieved. For the dairy sector, three government agencies (i.e. Canadian Milk Supply Management Committee (CMSMC), Canadian Dairy Commission (CDC) and provincial marketing boards) are directly involved in the administration of the national quota program (Canadian Dairy Commission, 2004). The Canadian Milk Supply Management Committee (CMSMC) is in charge of determining the level of national industrial milk production and allocation of this level to the individual provinces. The Canadian Dairy Commission (CDC) is principally responsible for setting prices and levies for "within-quota" and "over-quota" milk sales. Provincial marketing boards and departments of agriculture are responsible for administering the national program within their provinces.

How does the supply management system work in these sectors? In the poultry and egg sector, the national producers' agency, in consultation with the processors (both co-operatives and IOFs) at the national level, sets the country's production requirements which are subsequently divided among provincial producer marketing boards. Poultry processors hold significant amounts of quota in some provinces, and have contractual arrangements with producers for significant amount of production in all provinces (Lyons and Begleiter, 1984). In the dairy sector, milk utilized in manufacturing dairy products (industrial milk) is regulated by a national quota program and milk used in fluid products is subjected to separate provincial quotas. Because industrial milk and its products are sold nationally and internationally, they are regulated on a national basis. Fluid milk used to be marketed within each province and was consequently subject to provisions defined by provincial quota programs. The federal and provincial governments authorize provincial milk marketing boards and agencies to do that. To achieve the levels of prices that apply under the supply management systems for the poultry, egg and dairy sectors, imports are tightly controlled. The boards argue that the regulatory body cannot accurately control how much product is brought to the market if consumers and buyers are able to import at will, and producers can sell outside the supply regulations.

The main objectives of supply management are (i) to stabilize prices, (ii) to stabilize incomes, (iii) to increase price and (iv) to increase gross income for producers (Van Kooten, 1988). The benefits to producers of a supply-managed market over the unregulated market may include the security it generates and a price level that is higher than that which would prevail in a free competitive market. One feature of the supply management program is that it involves little direct burden on the government treasury.

However, it is argued that the policy would have been more efficient if government were to subsidize the farmers directly (Barichello, 1982). Barichello notes that it is difficult to measure efficiency gains under the program when fewer resources are needed to protect against risk.

A number of problems have been noted as a result of the effects of supply management. Consumers are increasingly unwilling to accept the high price that the program generates (Schmitz and Schmitz, 1994). According to Veeman (1997), the influence of trade issues on Canadian agricultural marketing policy has increased as the trade barriers have fallen between Canada and the US. The General Agreement on Tariffs and Trade (GATT) has rendered several of the policy tools on which supply management relies inappropriate (Janmaat, 1994).

The recent dairy-related trade dispute between Canada and the US (with New Zealand) is of interest. The US claimed that Canada had been unfairly subsidizing its dairy exports. As part of its Uruguay Round WTO obligations, Canada had agreed to specific limits on export subsidies for dairy products. In 1995, Canada replaced its system of subsidy payments on dairy exports. The new system, let Canadian processors buy lower-priced milk and use it to make cheese and other dairy product for export. This system was challenged by the US because Canada's dairy trade practices were inconsistent with WTO obligations on export subsidies. The US and New Zealand filed a complaint to a WTO dispute settlement panel in 1998. The US and New Zealand again lodged a complaint to the WTO dispute settlement body in 2001 and on July 11, 2001, the WTO confirmed that Canada has failed to eliminate export subsidies on milk and other dairy products. Subsequently Canada agreed to reduce exports. As a result of the

WTO ruling, all Canadian provinces eliminated the Commercial Export Milk (CEM) program and as of August 1, 2003, no subsidized dairy exports have entered the United States or elsewhere from Canada.

An important issue is whether the behavior of the marketing co-operative agribusiness firm is different when regulatory constraints on raw material supplies and prices apply, as in supply management. Looking at the trends in the various types of co-operatives, it is evident that marketing co-operatives are an important group of agricultural co-operatives. Within the marketing co-operatives, the co-operatives that are supply- managed (dairy, poultry and eggs), have the highest market shares (Table 3). They also contribute significantly to the total revenues of marketing co-operatives. Would regulatory constraints have anything to do with this?

Members (i.e. agricultural producers) of co-operatives in the supply-managed sectors want the supply management system to stay. Members of marketing co-operatives are in favour of this policy because they are concerned about retaining the return on their sales that apply within this system. One question therefore is, whether restrictions from the regulatory environment actually operate to the advantage of the co-operatives involved and their members? A key factor that may determine the role that co-operatives play in the marketing of products is their interaction with the regulatory structure in which they operate. For example the regulatory system may reduce the ability of the co-operative to adjust to changing market conditions. Also, growth of the co-operative may be limited and the co-operative may have mixed strategies because members have the desire to keep supply management (where most of their money comes from) and do not pay that much attention to co-operative profits. According to Hailu (2005), supply

management may serve as a monitoring system. If supply management perceived to give an edge to co-operatives operating under it, then monitoring the performance of such co-operatives is imperative.

Answers to these questions may have important implications for the future success of co-operatives. It could be hypothesized that regulatory restrictions may affect the relationship between agribusiness co-operatives and their members. This might explain why some co-operatives have gone out of business while others have struggled for survival (e.g., Agrifoods International in the dairy industry, Alberta Wheat Pool, Manitoba Pool Elevator, Saskatchewan Wheat Pool and United Grain Growers in the grain industry). There is no empirical study that addresses the impact of the regulatory environment on the performance and ultimate survival of co-operative businesses. This study will seek to address this issue.

1.2 Significance of the Study

It is clear that co-operatives have been very helpful to their members (Barton, 1989). Many people have discussed the issue of regulations in the supply of certain products and how it affects their market (eg. Proulx et al. (1991)). With the exception of one study by Janmaat (1994) on "Marketing co-operatives and supply management: a case study of the British Columbia Dairy Industry", no research has been done on the effects of regulatory restrictions on the performance of marketing co-operatives in Canada. According to Janmaat (1994), the principal effect of supply management restrictions is to guarantee that there are profits available to producers. Canadian processors have an interest in the outcome of supply management. The processors argue that supply management restrictions prevent them from achieving economies of scale

(Funk and Rice, 1978). Secondly, quotas result in higher raw-material prices for processors, putting them at a competitive disadvantage in the world export markets (Schmitz et al., 2002). Proulx and Saint-Louis (1978) found evidence of a positive influence of supply management on farm-level productivity but expressed some reservations about the eventual implications of quota values which were beginning to emerge at that time. However, Richards (1996) concluded that farm productivity was lowered by supply management. Are these restrictions really making all the members of the co-operatives better off? The regulatory environment of supply management makes it more difficult for producers to expand due to the fixed quantity they are allocated to produce, thus reducing the size range of co-operative members. It also provides a more secure return to small producers, reducing their reliance on the co-operative's patronage dividend (Janmaat, 1994).

One question, therefore, is what are the economic impacts of the regulatory systems on the performance of the marketing co-operatives operating under supply management? Also, the supply management system accomplishes a number of objectives, in particular bringing stability to the industry. However, this stability comes at a cost which the entire economy pays. One theory is that co-operatives are created to deal with market failure, therefore if they are operating under supply management, are they acting as pro-competitive forces to improve market performance and producer welfare?

This study will contribute to the existing literature on supply management and also bridge a gap in the literature on the effects of supply management on the performance of marketing co-operatives.

1.3 Objectives of the Study

The general objective of this study is to evaluate the performance of marketing co-operatives. The specific objectives of the study are:

1. To use a number of different tools to examine the performance of marketing co-operatives in sectors that are supply managed and those that are not.
2. To examine the implications for producers and consumers of marketing co-operatives with and without the regulatory environment of supply management based on (1).

1.4 Organization of the Thesis

The study is divided into five chapters. In Chapter One, the background to the study and the nature of the problem are discussed. Literature on the economic theory of co-operatives in general and marketing co-operatives in particular is reviewed in Chapter Two. The effects of the regulatory environment on the operations of co-operatives, the various marketing structures of co-operatives, firm performance measures and the different models that have been used in other studies to measure the performance of co-operatives are also reviewed in this chapter.

Firm performance measurements of co-operatives taking into account the effect of the regulatory environment are discussed in Chapter Three. The various factors that are perceived to affect the performance of supply-managed co-operatives as well as the non-regulated co-operatives are discussed, as is a conceptual model that will be used in the measurement of performance. Based on the conceptual model, an empirical model is developed and is used in the subsequent estimation.

The description of the data that are used, how the data were collected, and the sources of the data are discussed in Chapter Four. The models used and how the data are used in the models are also outlined. The results obtained from the model and the explanation of the results based on theory are also discussed in Chapters Four and Five. The implications of the results for different marketing co-operatives (i.e. those under supply management and those that are not) are also mentioned. A summary of important findings made and suggestions for changes or for future research are discussed in Chapter Six.

2.0 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Firm performance measures can be important in assessing how well a firm is doing and whether it will be able to continue in business. As multiple concepts of firm performance can be defined, it is logical that multiple measures of firm performance exist. The measure of performance of firms may be unique to every particular firm depending on the goals or objectives set by that firm. During the past decade, both academics and practitioners have stressed the importance of a well functioning system of performance measurement in order for firms to thrive, or survive, in an increasingly competitive environment (Brimson, 1991; Johnson and Kaplan, 1987). Many studies have been done on firm performance in general but only a few on the performance of co-operatives in particular. The orthodox theory of the investor-owned firm assumes that the objective of the firm is to maximize profits, so it follows that performance measures have been developed based largely on this theory. Whatever a firm's objectives are, business performance measures provide an evaluation of the extent to which these objectives are being achieved (Jarvis et al., 1999). Grant (1991) noted in his study that all stakeholders have a shared interest: the survival of the firm. To survive, therefore, a firm needs to earn, in the long term, a rate of return that covers its cost of capital. As this is a financially oriented criterion, one can argue that in the end, the interest of every stakeholder is linked to the financial well-being of the firm. To be able to better assess the performance of a firm, it is important to understand the principles and theory on which the firm is based.

The review in this chapter will therefore contribute to a better understanding of performance measurement.

The principles and theory of co-operatives and how these affect their behaviour is discussed in this chapter. The economics and marketing strategies of marketing co-operatives are examined to help us understand their objectives and how they operate. Since the main objective of this study is to assess the effects of supply management on the performance of marketing cooperatives, it is important and necessary to review studies on firm performance, performance measurements of co-operatives, and studies on regulation and its effects on performance. The principles of supply management, how it operates and is managed are also presented. Literature on how supply management affects processors, producers and consumers is also discussed. At the end of this chapter, taking into account the objectives of the study, the types of performance measurement will be chosen to evaluate the performance of marketing co-operatives, in both a regulated and an unregulated environment.

2.2 Theory of Co-operatives

The International Co-operative Alliance (ICA) defines a co-operative as "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise". A co-operative is an organization that is owned and controlled by the people who use its products, supplies or services. Co-operatives are a form of collective action in which individuals join together to accomplish what would be more costly or impossible to achieve individually. Co-operatives are regarded as a unique form

of business organization, yet they operate in the same economic environment as investor-owned firms (IOFs), i.e. buying, selling, and producing goods and services. However, unlike IOFs, they also aim to provide service to their members, not only earn a return on an investment. Co-operatives distribute profits or surpluses according to patronage and not according to investment made by shareholders, like IOFs do.

Co-operatives differ from IOFs in several ways; these differences have been summarized by Condon (1987) as follows:

1. The primary purpose of co-operatives is to meet the common needs of their members whereas the IOF's primary purpose is to maximize profit for its shareholders.
2. Co-operatives use the one-member one-vote system, not the one-vote per share system used by IOFs. This helps the co-operative to serve the common need rather than the individual need of its members.
3. Co-operatives share their profits among their members on the basis of how much the members use the co-operatives, not on how many shares they hold. Co-operatives also tend to invest their profits in improving service to members and promoting the well-being of their communities, for which no market values may be available.
4. Ownership structure of the co-operative is different from that of IOFs. Co-operatives are user-owned firms: owners are at the same time the patrons. For the IOF, the firm transacts business with clienteles that are typically separated from the investors who own the firm. The difference in objectives between co-operatives and IOFs stemming from this dissimilarity in ownership structure suggests a number of distinctions in business and financial strategy of both types of firms (Condon, 1987).

5. Co-operative equity, unlike IOF stock, is not marketable. Non-patrons therefore have no motivation to invest in a co-operative. As a result, there are no secondary markets for co-operative stock and co-operatives are restricted to raising equity from member-producers who use the services of the co-operatives (Lerman and Parliament, 1992). Members may be reluctant to allow the co-operative to increase its equity base through retained earnings, because retention of earnings translates into lower effective prices for marketed products or higher effective costs of farm inputs. On the other hand, shareholders in IOFs are indifferent, at least in theory, between cash distributions and retained earnings, because the latter appreciates and can be realized by investors through selling their shares in the secondary market (Brealey and Myers, 1991).

There are some potential advantages that co-operatives may have over IOFs even though these may be difficult to quantify. But the greatest evidence that there are benefits to co-operative organizations is seen in the fact that they continue to exist in spite of clearly identifiable structural shortcomings such as capitalization challenges, limitations in their ability to react quickly to changing market conditions (Ernst and Young, 2002). The co-operative structure is supposed to offer the opportunity for more communication between management and the members. Management of a co-operative may be able to respond better to the concerns of the members on how services are delivered when compared to those of IOFs. The co-operative setup is also supposed to allow membership to be better informed of the market conditions that determine the success of the co-operative, and may provide the members with the information to be able to respond more rapidly to these changes. The co-operative setting offers a potentially highly effective

mechanism for the dissemination of information on production techniques and industry direction.

In appraising the role of co-operatives in a society, Maxon (1973) pointed out that co-operatives must earn their place in society by providing members with goods and services that are equal to, or better than, those available from any other source. He emphasized that:

"*Co-operatives must be considered first and foremost as business organizations whose activities are economically motivated and methods of operation are as modern and efficient as can be provided by any other type of organization*".

The major difference between an IOF and a co-operative is their primary or main objective. An IOF's main objective function is to maximize profits,

$$\text{Max } \pi = \{P_i * F(X_1,\ldots,X_n) - w_i * X_i\} \quad \ldots\ldots(2.1)$$

where π = firm's profit

P_i = output price

$F(X_1,\ldots,X_n)$ = production function of the IOF

w_i = input price

X_i = quantity of input

Agricultural producers form marketing co-operatives to defend and look after their own needs in marketing their output and other services. Marketing co-operatives are institutions set up by producers and run by these producers for their own benefits. The marketing co-operative is put in place to help these producers process their produce and sell it on the final market. For the marketing co-operative, its main objective is to

maximize the welfare of its members. To be able to do so, it must maximize profit as well as producer surplus (Fulton, 2003). Following Enke (1945),

i.e. Maximize $W = \max \pi + PS$.....(2.2)

where PS is producer surplus.

Producer surplus is normally defined as returns to fixed factors of production minus variable costs. It may also be defined as gross profits and economic rents. The welfare of the members will be maximized if the co-operative is able to maximize profit plus producer surplus.

2.3 Economics of Marketing Co-operatives

A marketing co-operative is an organization formed for the benefit of its members. It can be viewed as a form of vertical integration – i.e. the members have integrated downstream and replaced the purchasers of their output with an organization they themselves control. In other words, the members are suppliers to the firm they own; they have the ability to take into account the impact on themselves of decisions made by the co-operative. The main aim of a marketing co-operative is to purchase raw materials from its members (i.e. producers) at a price, process it into a finished product and sell it on some final market at a different price. Marketing co-operatives enable producers to (1) correct market failure where prices are too low or buyers have left the market; (2) provide a service not available otherwise; (3) gain market power (i.e. negotiating power) (Lerman and Parliament, 1992).

The creation of a marketing co-operative may produce an effective or more efficient marketing system by increasing the competition in marketing of farm commodities and by providing more outlets for the farmers to dispose of their produce.

The marketing co-operative may potentially increase farmers' incomes by improving their negotiating position in the sale of their product, reducing profit-margins and applying standards of type and quality of the product produced such that it meets the needs or wishes of customers (Dooren, 1982).

Ward (1995) argues that the success of a marketing co-operative depends on the level of participation of its members in its economic operations, good repayment ratio on loans, high volume of investment by members within the co-operative and strong group effort by members in general as well as sound financial practices (Ward, 1995). When members or patrons sell their output to a marketing co-operative, the co-operative uses this output as an input in its production process. The members may choose to patronize the co-operative rather than an investor owned firm (IOF) because they desire a higher price for their products, and a positive patronage refund which increases the net price they receive. They also rely on the co-operative to market their products for them (Ward, 1995).

The distinction between co-operatives and other businesses is that co-operatives return net income as patronage refunds to their users or members. IOFs do not distribute patronage refunds like co-operatives do. Net income is distributed to investors based on investment rather than patronage. Thus, to maximize net income, IOFs simply purchase inputs from producers until the marginal net revenue from selling the processed products equals the marginal input cost of buying the input (Fulton, 1995). If an IOF is competing for producer's products in a competitive input market, the price the IOF pays for the input is equal to marginal input cost. If the IOF's input purchases affect the price level of the input, the marginal input cost will be higher than the input price.

The objective function of marketing co-operatives as analyzed by Fulton (1995) is given below. In a competitive market, the profit function of a co-operative is given by:

$$\pi = P_y Y - P_x X_0 - F \quad \text{..... (2.3)}$$

where

P_y = per unit price of output

P_x = per unit price of input

Y = quantity of output produced from input X_0

F = fixed cost of producing Y.

The producer surplus, PS can be expressed by;

$$PS = P_x X_0 - \int_0^{X_0} P(X)dX \quad \text{.....(2.4)}$$

where

$P(X)$ = member's supply curve

$\int_0^{X_0} P(X)dX$ = variable cost of producing X_0

Thus substituting equation (2.3) and (2.4) into equation (2.2), we get the following:

$$\text{Maximize } W = P_x X_0 - \int_0^{X_0} P(X)dX + P_y Y - P_x X_0 - F \quad \text{..... (2.5)}$$

$$\text{Maximize } W = P_y Y - \int_0^{X_0} P(X)dX - F \quad \text{.....(2.6)}$$

2.3.1 Marketing Co-operative in a competitive market

Following Fulton (1995) assume a perfectly competitive market situation where there are numerous firms, IOFs and co-operatives purchasing inputs (X). In such a situation, the co-operative cannot influence the price it pays for inputs from its members; it has to pay the same price as other competitors. Therefore, input price is given and the input demand curve of the co-operative is horizontal. A horizontal input demand curve implies the co-operative can purchase any quantity of input at the given price. It also implies that the level of producer surplus is fixed. In this case, in order to maximize producer welfare, the co-operative must maximize profits like IOFs do. Thus in a competitive market, a co-operative can maximize its profits if it chooses an input purchase level such that marginal benefit from additional input is equal to the given price of input (i.e. Marginal Revenue (MR) = Price (P)).

Before deriving the optimal price and quantity solutions, it is necessary to understand the concepts of Marginal Value Product (MVP) and Net Average Revenue Product (NARP) because these concepts center on the production function used by the marketing co-operative to transform the input X into the final output, Y (Nicholson, 1995).

The production function for the marketing co-operative can be expressed as:

$$Y = f(X_0) \quad \text{.....(2.7)}$$

$$\frac{\partial Y}{\partial X_0} = MPP \quad \text{..... (2.8)}$$

where

MPP = the rate at which the level of output changes with respect to a change in the level

of input used.

$$MVP = MPP * P_y \quad \text{.....(2.9)}$$

where

P_y = price of output.

MVP is the change in revenue that the marketing co-operative would receive for a change in the level of input used. It also represents the marginal benefit to the co-operative of using an additional unit of input X_0.

The other concept, NARP, is the amount that the marketing co-operative has available to return to its members on the basis of per unit of input X_0. Following Fulton (1995) it is given as:

$$NARP = \frac{P_y Y - F}{X_0} \quad \text{.....(2.10)}$$

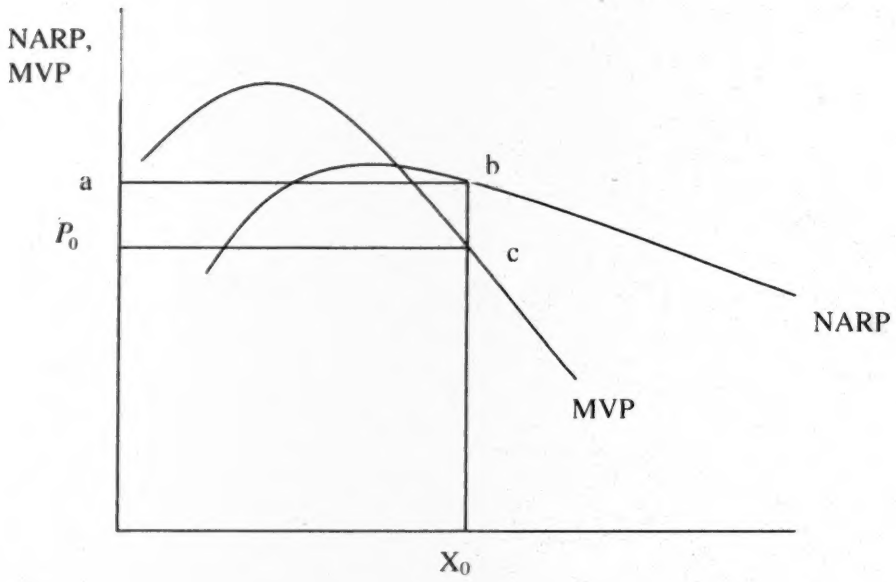


Figure 2: Marketing co-operative in a perfectly competitive market.

Source: Co-operatives in Agriculture (Cobia and Brewer, 1989).

The marketing co-operative will maximize profits from the sale of output Y by buying X_0 at the price of P_0. The co-operative will make profit equal to the area of $abcP_0$ in Figure 2. With a similar production function for the IOF in this market, the IOF also chooses the same level of quantity as the co-operative. The difference here, however, is that for the co-operative, any profits that are earned are returned to the members. Thus the co-operative member receives price of P_0 and patronage refunds equal to value a-P_0 for each unit of commodity.

Marketing co-operatives may have potential problems in a competitive market due to their difference from other firms. For example, like IOFs marketing co-operatives need an adequate and continuous supply of agricultural produce to remain successful and they must compete on price with private middlemen for the produce of members or potential members. The co-operative must either arrange contractual obligations with its members or depend on the loyalty of members for regular input deliveries. The co-operative could be forced out of the market if the co-operative is unable to match the financial resources or management skills of investor-owned firms.

2.3.2 Marketing Co-operative As A Monopsonist

The assumed conditions of a perfectly competitive equilibrium input market are rarely achieved. This may be due to industry entry barriers (Schmiesing, 1989). When the marketing co-operative is not one of many small firms in the industry but is actually the only buyer in the market, the marketing co-operative can consider two optionsmaximize members' welfare by equating its marginal benefit of input to the marginal cost of producing that input, i.e. by exerting its monopsony power.

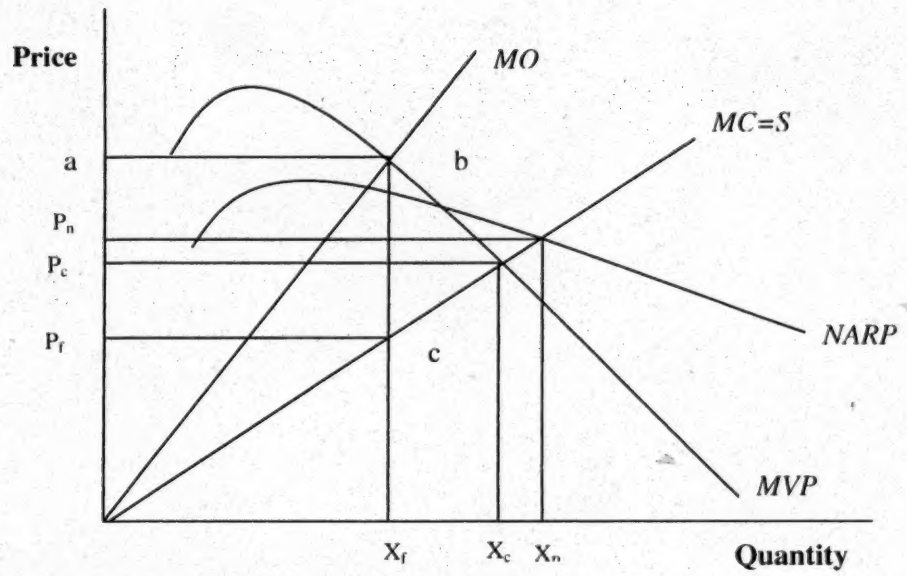


Figure 3: Co-operative and IOF as a Monopsonist in a Market
Source: Co-operatives in Agriculture (Cobia and Brewer, 1989).

Marginal outlay (MO) can be defined as the marginal cost to a monopsony of buying an additional unit of input.

where:

MO = Marginal Outlay = $\frac{\partial TO}{\partial X}$

TO, Total Outlay = MC*X

MC = Marginal Cost

S = Supply

In Figure 3, it is assumed that the marketing co-operative equates its MVP with its MC. At this point, it buys X_c amount of inputs from its members at a price of P_c. This price and quantity are lower than would have been the case in a competitive market. If the IOF was to be the only buyer in the market, it would pay producers P_f for X_f quantity

of inputs. This price and quantity are lower than that of the co-operative. In that case, if there is only one buyer in the market, producers will be better off if that one firm is a co-operative. However, the marketing co-operative must set price at the point where MVP meets MC if it wants to maximize its members' welfare. To maximize its members' welfare, the co-operative must equate its MVP with its MC and then distribute the difference of the NARP and MVP as patronage to the members. When this happens, the producers receive a price of P_n for their produce and they supply X_n amount of produce. A NARP pricing co-operative distributes all revenue through the price it pays to its members. And according to LeVay (1983), the producers will be better off with the NARP pricing than with the MVP pricing.

Cobia and Brewer (1989) claimed that most co-operatives in the U.S. follow a MVP pricing rule for the following various reasons: (i) fear of retaliation from competitors (ii) desire to finance growth of co-operative through retained member patronage earning and (iii) to avoid free rider problems by non-members. On the other hand, some co-operatives have chosen to use NARP pricing for the following reasons: (i) the co-operative's desire to exert competitive behaviour on IOFs (ii) to encourage members to patronize the co-operative with an immediate benefit for members. However, regarding the second reason, co-operatives may not be able to stay in business if they make this their long term strategy (Cobia and Brewer, 1989).

2.3.3 *Effect of regulation on marketing strategy of marketing co-operatives*

In certain marketing co-operatives, marketing strategy may be affected by the influence of the regulatory environment. Examples in Canada are in the dairy, poultry and egg sectors. Price is set

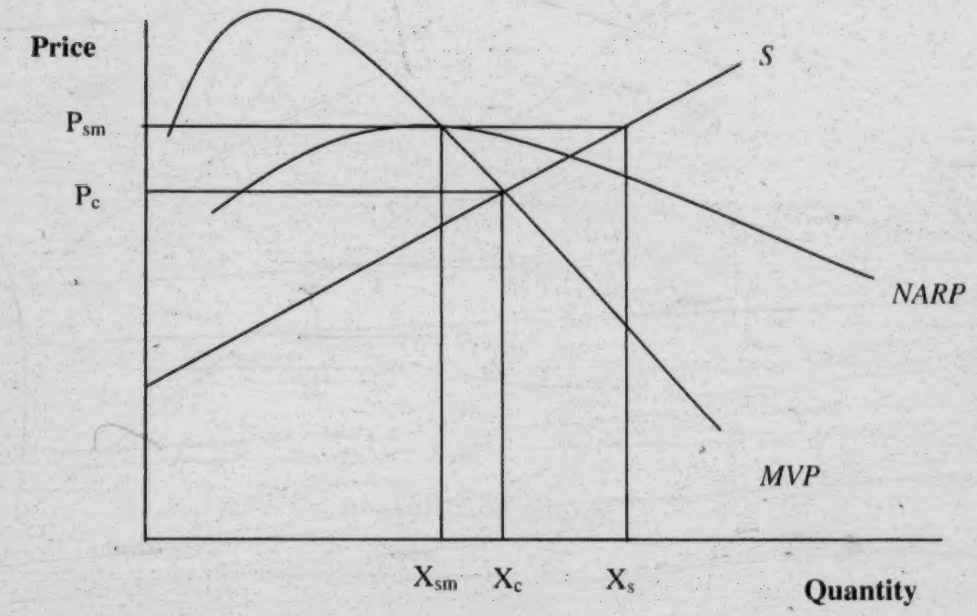


Figure 4: Co-operative in a regulated market

Source: Co-operatives in Agriculture (Cobia and Brewer, 1989)

and the quantity of input that producers deliver to the monopsonistic co-operative or IOF is based on the assumed supply curve, S as shown in Figure 4.

In Figure 4, assuming perfect competition, the marketing co-operative and the investor owned-firm are assumed to originally be paying producers P_c (the equilibrium price in the market) and accepting X_c quantity of input from producers. Assuming with

the introduction of the supply management system that the price is now fixed at P_{sm} and the quantity is now X_{sm}. The marketing co-operative will now be paying its members P_{sm}.

For example, let us analyze a situation where a poultry co-operative provides processing facilities in its locality. Assume a fixed 'production' function for turkey. Given a total cost function of producers, the co-operative is willing to pay $2,500 per thousand birds (i.e. P_c in Figure 4) to the producers. Given the producers' cost function, a producer will be able to supply say 62,500 birds to the co-operative (X_c in Figure 4). Assuming that the farm price of live turkey is fixed by national supply management legislation at $2800 per thousand turkeys (P_{sm} in Figure 4), with the introduction of a regulated price, the producers are willing to supply X_s amount of birds to the co-operative, but the co-operative will only be able to accept X_{sm} amount of birds. At this price, given the cost function of the producers, a producer will supply 60,000 turkeys to the co-operative. Thus, without supply management, a producer will receive $156,250 (2,500*62.5). With supply management, even though the producer would be willing to supply X_s amount of birds, the production quota would limit sales to X_{sm} amount of birds. However, even though the producer supplies fewer birds now than before supply management, he will receive $168,000 (2,800*60). In this illustration, it is seen that the producer is better off (i.e. in terms of revenue not producer surplus) with supply management. This is true only if profits from processing do not decline by more than the difference in revenue to farmers and if the farmers do not have to pay for production quota. There is a trade-off between farm revenue and the co-operative's profit.

2.4 Studies on Regulation and Performance

The regulatory environment in which a business operates shapes the attitudes, plans and strategies which are necessary tools for that business to be successful. Mahon and Murray (1981) posit that in a regulated setting, an organization's industry environment is clearly defined with only few external actors attempting to influence the firm. In an unregulated situation, the industry environment of a firm involves a large number of actors which imposes the necessity of making competitive decisions on the firms acting in that environment if they are to survive. Mahon and Murray also indicate that in a regulated environment, regulation may serve as a buffer which protects the firm from what Porter (1980) has termed the five basic competitive forces of a market. These forces according to him are: (1) threats of new entrants, (2) rivalry among existing firms (3) bargaining power of customers, (4) threats of substitute products or services (5) the bargaining power of suppliers. This suggests that regulation tends to neutralize competitive actions, which may have an effect on performance.

Although several researchers have argued that the external environment limits the range of viable strategic options and limits performance (Hambrick and Lei, 1985; Miller, 1987; Venkatraman and Prescott, 1990), other studies (Day and Lord, 1988; Govindarajan, 1989; Thomas et al., 1991) have proposed that this may not be the case and that managers of a firm continue to be important arbiters of firm performance. Given the dominance of industry-level phenomena in most prior economic research, very little is known about how individual firms react to centrally administered environments and how they compete to achieve superior profitability over other firms (Ramaswamy et al., 1994).

There has been growing suspicion that the process of regulation in many industries has not resulted in superior market performance. Instead, it has been argued that regulation either has had no effect on the markets in which it operates or that it has caused society to incur substantial social costs (Richards, 1996). Other schools of thought have argued that regulation is only a means for producers to improve their own well-being at the expense of consumers and society as a whole (Schmitz and Schmitz, 1994).

How then does the regulatory environment under which certain businesses are operating affect their performance? How are co-operatives in the dairy and poultry and egg industries faring under the supply management system? Studies by Mahon and Murray (1981) have theorized that the articulation of strategies in regulated industries is difficult if not impossible.

Albon (2000), commenting on the links between performance measurement and regulation, stated that when a reform process or regulation is in place, performance measurement over time is essential in assessing the success of this regulation with regards to producing better outcomes. Thus performance measures will throw more light on the effects of regulatory environment on the operations of the co-operatives operating under it. A study carried out by Richards (1996) to investigate the effect of supply management on dairy productivity, using a cost of adjustment model on data from a sample of fluid milk producers in Alberta from 1975-1991, showed that productivity growth of these producers is lower under the supply management system.

Janmaat (1994) carried out a study on the effect of supply management on the performance of the British Columbia dairy industry with emphasis on the co-operatives in the industry. Janmaat used the asset valuation model to examine the effect of certain

variables he identified as being indicators of the success of a co-operative (consumer price of milk and the rate of return generated by the Toronto Composite 300 index) on the price of quota. Janmaat wanted to find out how these variables relate to the price of quota which is an indicator of supply management. He found that the price of quota is positively related to these variables; inferring that the success of co-operatives is somewhat related to the price of quota.

Ramaswamy et al. (1994) were of the view that there was not adequate understanding of the manner in which regulated organizations make strategic choices that drive performance outcomes. The study assessed whether there is a significant relationship between strategy and performance in regulated organizations, based on 20 certified air carriers in the U.S. airline industry. They developed measures to capture the dimensions of strategy in the industry, using five indicators of managerial discretion and two indicators of the regulatory body. They then measured financial performance in terms of two indicators, Return on Assets (ROA) and Return on Total Capitalization (ROTC). They used a multiple linear regression methodology to regress the strategy indictors against the two indicators of performance. The results showed that all the managerial-controlled factors were significantly related to performance, while none of the factors attributed to the regulatory body were significant. They concluded from their results that despite the control by the regulatory body, managers were still able to handle competitive factors to increase their profitability.

Another study was carried out by Reger et al. (1992) on the U.S. banking industry to test the effects of government regulation and deregulation on strategic choice and in turn, financial performance. For their model, they identified strategic choice factors and

indices for regulation. The authors used Return on Assets (ROA) as a measure of financial performance. A path-analytic framework was used to assess the proposed relationships. Path coefficients were derived by regressing each variable on all prior variables in the model. The results of the final path model suggested that the influence of deregulation on strategic choice and performance is complex, even though they were not significant.

Salerian (2003) reviewed an index number framework that links changes in aggregate performance measures (such as profit, revenue, cost and total factor productivity) to changes in both the prices and quantities of key outputs and inputs. This framework provides a way of linking the aggregate performance measures to outcomes for individual customer groups, employees and owners of businesses. The framework may be useful in monitoring the consequences of regulation on performance. Salerian used the logarithmic version of Fisher's Ideal index for his study.

Marketing co-operatives are major market agents and play a crucial role in market regulation. In addition to their market positions, marketing co-operatives are sometimes used as government agents and are instrumental in the implementation of agricultural policies. Tennbakk (2004) carried out a study on agricultural markets in Norway to analyze the efficiency of agricultural regulations in Norway. For his study, he chose a marketing co-operative and an investor owned wholesaler. He noted that marketing co-operatives are instrumental in the implementation of agricultural regulations but may not be able to perfectly control market supply because of their competition with investor-owned wholesalers. He observed that in Norway, co-operatives dominated the dairy, meat, and eggs and poultry industries. To be able to hold a market coordinating and

dominating role, the co-operatives must accept all deliveries offered to them, even from non-members because their failure to do so would turn their members and non-members away to the investor-owned wholesalers. The co-operatives can accept deliveries from their members and non-members alike by regulating supply through paying farmers to deliver less or by withholding production from the market. This involves extra costs. Tennbakk (2004) used a general model of mixed duopoly to model the market implications of co-existence of a marketing co-operative and an investor owned wholesaler in the regulated Norwegian agricultural market, taking into account that farmers may choose wholesale affiliation if it is profitable. Tennbakk specified a cost function and a market demand equation for the co-operative and the investor-owned wholesaler and then developed a total mixed duopoly market supply equation for both organizations. He also hypothesized a situation where all farmers are members of the co-operative and thus behave like a cartel. He concluded that the effect of the regulatory model applied in the Norwegian agricultural markets is paradoxical. Given that the marketing co-operatives are behaving like market regulators, farmers enjoy a higher market price. On the other hand, competition is encouraged.

Studies by Matsumura and Matsushima (2003) on the role of the public firm in a mixed market and the effect of price regulation looked at the behaviour of a profit-maximizing private firm and a welfare maximizing public firm using the mixed duopoly approach. They used this approach to understand how a profit-maximizing private firm chooses its location based on how a welfare maximizing public firm chooses its location and vice versa, taking into account price regulation. Their study also looked at the effect of the price regulation on the choice of location. The choice of location the welfare

maximizing public firm makes impacts the welfare of the public. From their results, they found that due to price regulation the choice of location made by the public firm did not improve welfare.

The efficiency of regulation has also been the focus of study for some time now. Studies have been carried out to examine the efficiency of regulations put in place in various sectors. Aubert and Reynaud (2005), carried out a study on the Wisconsin Water Utilities to find out the effect of regulation on the efficiency of water utilities. They used a stochastic cost frontier approach of cost efficiency, analyzing a panel data of 211 water utilities observed from 1998 to 2000. They expressed unobservable efficiency as a function of exogenous variables (i.e. volume of water sold, number of customers, and prices of the various inputs used in the production process). Their results showed that regulation had an adverse effect on the efficiency of water utilities in Wisconsin. Further studies on efficiency measures are discussed later in this chapter.

2.5 Firm Performance

Venkatraman and Ramanujam (1986) define performance as the time test of any strategy; it is an assessment of how well a firm has succeeded in reaching its objectives. It also informs a firm on whether customers are satisfied and if improvements are necessary. As multiple concepts of firm performance can be defined, it is only logical that multiple measures of firm performance exist to operationalize these concepts. The appropriate measures of performance depend on the performance concept that is selected by the firm. During the past decade, both academics and practitioners have stressed the importance of a well functioning system of performance measurement in order for firms to survive or thrive in an increasingly competitive environment (Brimson, 1991; Johnson

and Kaplan, 1987). Many studies have been done on firm performance in general but only a few on the performance of co-operatives (summaries of these are seen in Table 89 in the Appendix). Grant (1991) noted that all stakeholders have a shared interest: the survival of the firm. To survive, therefore, a firm needs to earn in the long term, a rate of return that covers its cost of capital. As this is a financially oriented criterion, one can argue that in the end, the interest of every stakeholder is linked to the financial well-being of the firm. The measures of performance used often prioritize profit maximization, using indicators such as return on investment and profit margins as key indicators.

Much criticism has been directed at the traditional systems of performance measurement (mainly financial and accounting ratios) and their focus on financial results and inability to consider the strategic aspects of business (e.g. (Dixon et al., 1990; Kaplan and Norton, 1996)). But Fisher and McGowan (1993) argue that provided it is corrected for risk, the economic rate of return may be the only correct measure for economic analysis. The debate on this subject involves number of books and articles on how performance measures should be designed and used, including several 'new' concepts such as a Balanced Scorecard, Performance Pyramid, and Value-Based Management (Kaplan and Norton, 1996; McNair et al., 1990). Subsequently, there have been several studies with the purpose of empirically determining whether competitive situations have affected the design and use of systems for measuring performance (Kald and Nilsson, 2000). These studies show, for example, that performance measurement has broadened to include non-financial measures (e.g., Bromwich and Bhimani, 1994; Fitzgerald et al., 1992). However, much of this interest has been directed at larger and well-established

firms (Kald and Nilsson, 2000). Firm performance has been described as in the diagram in Figure 5.

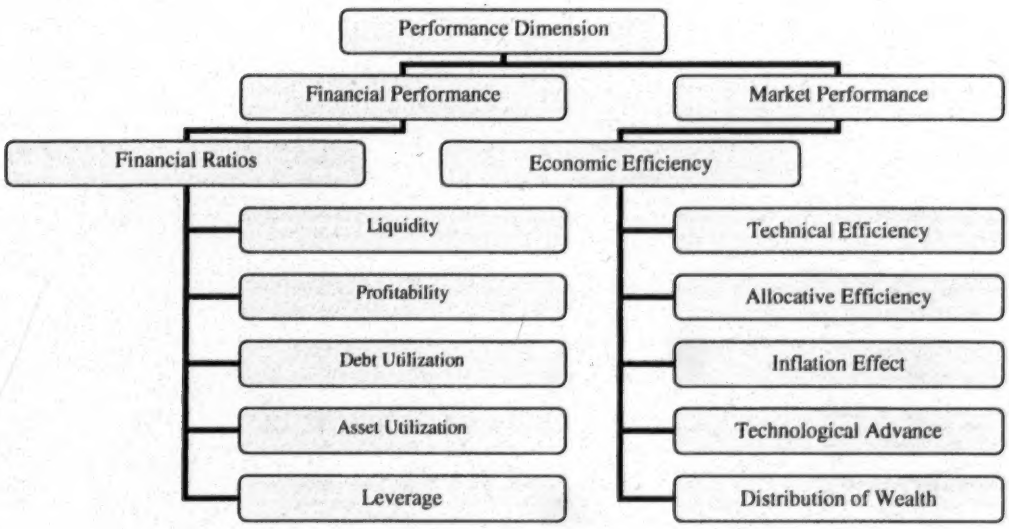


Figure 5: Analyses of Performance Dimension (Source: (Scherer, 1980))

2.5.1 Implications of Co-operative Behaviour on Financial Performance

Co-operatives operate differently from IOFs because of the three basic co-operative principles that define the essence of a co-operative: user-owned, user-benefit and user-control. These principles have significantly affected the organizational behaviour of agricultural co-operatives in the US (Hardesty and Salgia, 2004). Sexton and Iskow (1993) summarized various studies that evaluate how co-operative structure can affect relative financial performance. They cite several studies that hypothesized how co-operatives are inefficient relative to IOFs because of the co-operatives principal-agent problem (e.g. (Porter and Scully, 1987)). Porter and Scully (1987) also argued that the

horizon problem has caused co-operatives to focus on short-term earnings at the expense of long-term opportunities. Co-operatives' profitability is also impaired when they lack sufficient patronage to achieve the cost-minimizing scale of operation. Gruber et al (2000) found that co-operatives are more likely than IOFs to participate in commodity-oriented markets with considerable product homogeneity and low margins. Conversely, Sexton and Iskow (1993) described how co-operatives can achieve cost savings by internalizing transactions through vertical integration and having better information flows than their IOF counterparts.

Lerman and Parliament (1990) concluded that the differences between the financial performance of co-operatives and IOFs are due to divergences in objectives and strategy between the two types of firms. They discussed how co-operatives are not considered to be rate-of-return maximizers; their members traditionally expect to receive their returns in the form of improved market access or higher output prices, rather than a direct return on their equity investment in their co-operative. These service benefits may reduce co-operatives' rate of return by lowering revenues and increasing costs. Lerman and Parliament hypothesize that the 'non liquid' nature of co-operatives' equity constrains their ability to raise capital from their members; consequently, co-operatives need to rely more heavily on debt financing than IOFs and thus are seen to be more leveraged than IOFs.

2.5.2 Previous Studies on Firm Performance Measurement

There have been a considerable number of studies on firm performance measures over the years. Even though the main objective of those studies was performance

measurement, several methods are used in the measurement or assessment. Performance measurement refers to the measurement of an activity or part of a firm, for example, operating income, product quality or customer satisfaction (Mattila and Ahlqvist, 2001). Performance measurement is said to have a strategic role and this has been stressed by a number of authors. Simons (2000), for example, argues that systems of performance measurement should assist managers in tracking the implementation of business strategy by comparing actual results against strategic goals and objectives. This author indicates that performance measurement systems can play a critical role as means of facilitating innovation and adapting to changing business conditions. Some reasons why performance is measured in a firm are: (1) to signal deviations from plans and expectations, (2) to ensure that operative goals are achieved, (3) to motivate employees, (4) to facilitate quality development, (5) to provide information for decision making, (6) to ensure that strategic goals are achieved, (7) to facilitate comparisons with other similar firms and (8) to create conditions for identification of strategic opportunities (Mattila and Ahlqvist, 2001).

The debate on what measures are preferable when measuring performance has been intense over the past years, including the discussion on the use of financial and non-financial measures (Hayes and Abernathy, 1980; Johnson and Kaplan, 1987). Consequently, studies have been carried out which suggest that performance measurement practice has broadened its focus to include non-financial measures (Fitzgerald et al., 1992). According to Mattila and Ahlqvist (2001), although financial measures are most common, non-financial measures are frequently used by entrepreneurial organizations. These include measures reflecting quality, productivity,

and resource utilization. Moers (2000), studying incentive effects of financial and non-financial measures, defined non-financial performance measures as those measures that reflect performance in the market, such as market share, market growth, and customer satisfaction. Moers argued that more focus should be made on non-financial measures because empirical research indicates that these measures are leading indicators of financial performance and will therefore provide managers with long-term incentives.

Mattila and Ahlqvist (2001) carried out a study on Swedish manufacturing firms to assess performance measurement in entrepreneurial organizations. Their objective was to enhance the understanding of how systems of performance measurement are designed and used in entrepreneurial organizations. They conducted a telephone and web survey on the design and use of performance measurement systems in twelve Swedish manufacturing firms in relation to five firm characteristics: entrepreneurial orientation, firm performance, firm size, firm age, and firm ownership. Their study focused on measurements of both financial and non-financial natures. They used a descriptive and explanatory approach to evaluate four models of performance measures: Balanced Scorecard, Value-Based Management, Intellectual Capital and Results, and Determinants Framework. These measures use a management approach to evaluate performance. Mattila and Ahlqvist employed Likert-type rating scales to assess whether a firm has higher or lower performance. The Balanced Scorecard is a management system that enables organizations or firms to clarify their vision and strategy and translate these into action. It provides feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results (Arveson, 1998). The Balanced Scorecard is carried out by developing metrics based on the

priorities of the strategic plan of the firm. Processes are then designed to collect information relevant to these metrics and reduce it to numerical form for storage, display, and analysis. Decision makers then examine the outcomes of the various measured processes and strategies and track the results to guide the company and provide feedback. Value Based Management is the management approach that ensures corporations or firms are run consistently on value normally by maximizing shareholder value. Intellectual Capital refers to the 'hidden' assets of a company which comprise human resources, knowledge, intellectual property and stakeholder relationships. This measure of performance examines these 'hidden' assets. Determinants Framework is developed to capture some determinants of the performance of a firm, based on these determinants of factors the performance of the firm is measured.

However, Meyer (2002), in his book entitled "Rethinking Performance Measurement", noted that the Balance Scorecard (a performance measurement model), which has been widely adopted by US firms, does not solve underlying problems of performance measures because it provides no guidance on how to combine dissimilar measures into an overall appraisal of performance. According to him, a measurement technique called Activity-Based Profitability Analysis (ABPA) is a better performance measure because ABPA estimates the revenue consequences of each activity performed for a customer by a firm, allowing the firm to compare revenues with cost for these activities. Hence it is possible to discriminate between activities that are ultimately profitable and those that are not. Meyer argued that performance measurement has proven challenging due to the gap in what we want to measure and what we can measure. He said that wanting to determine the performance of firms, we want to measure how

firms will perform but we can only measure how firms have performed in the past, and the past is not necessarily a reliable guide to the future (Meyer, 2002).

Jegers and Buijink (1987) carried out a study that reviewed the various performance concepts that were used in performance measurement in different studies. Tables 4 and 5 show a summary of the various performance concepts that were measured at the corporate and business levels.

Table 4: Corporate Level

Financial Based Concepts		**Operational**	**Organizational**
Accounting Based	**Market Based**	**Concepts**	**Concepts**
Profitability	***Market based concepts***	***Operations***	***Employees***
		*Value Added	*Wages
*Return on Equity	*Tobin's Q	*Productivity	*Employment Instability
*Return on Investment	*Marris V		
*Return on Assets	*Market Value	*Marketing & Sales*	
*Return on Sales	*Stock Price		
*Price Cost Margin		*Growth of Sales	
*Profit Level			
*Growth in Profits		*Firm Infrastructure*	
*Growth in Earnings per share		*Growth of Assets	
		*Asset Turnover	
Autofinancing Capacity			
		Technology Development	
*Cashflow			
*Cashflow/Equity			
*Cashflow/Total Assets		*R & D	
*Cashflow/Sales			
*Earnings Retention Ratio			

Source: Jegers and Buijink (1987)

Table 5: Business Unit Level

Financial Based Concepts		**Operational Concepts**	**Organizational**
Accounting Based	**Market Based**		**Concepts**
Profitability	***Market based concepts***	***Operations***	***Employees***
		*Value Added	*Wages
* Return on Equity	*Tobin's Q	*Growth in Vale Added	*Growth in Employment

*Return on Investment *Return on Assets *Return on Sales *Price Cost Margin *Growth in Price Cost Margin *Profit Level *Growth in Profits *Growth in Earnings per share *Price above Average Cost ***Autofinancing Capacity*** *Cashflow *Cashflow/Equity *Cashflow/Total Assets *Cashflow/Sales ***Other Accounting Based Concept*** *Z-Factor	*Marris V *Market Value *Stock Price *Market Value/ Equity *Market Value/ Sales	*Capacity Utilization *Productivity *Fixed Assets/Employee *Slack ***Marketing & Sales*** *Sales *Growth of Sales *Market Share *Growth of Market Share *Weighted Market Share *Advertising *Price ***Firm Infrastructure*** *Growth of Assets *Asset Turnover ***Technology Development*** *R & D	*Employee Unrest *Trade Union Organization *Bargaining Power of Union ***Various Stakeholders*** *Reputation with Stakeholders

Source: Jegers and Buijink (1987)

Huson et al. (2001) carried out a study to examine Chief Executive Officer (CEO) turnover and firm financial performance. They modeled firm performance as a function of managerial quality and chance. They hypothesized that quality, which is not directly observable, varies across managers. Firm directors attempt to infer quality from realized performance. For their study they constructed a turnover sample from a list of CEOs in the Forbes annual compensation surveys from 1971-1995. They also obtained data on turnovers from statements of the firms. Financial data was collected for each full year that an incumbent CEO was in office and this was used to calculate performance measures (operating rate of return on total assets (OROA) and to sales (OROS)). The performance measures were then regressed on CEO turnover. The authors concluded that accounting measures of performance relative to other firms deteriorate prior to turnover and improve subsequently.

Malina and Selto (2003) developed a performance measurement model (PMM) to help address two research questions: (1) on which criterion does a firm base its choices of performance weights and measures? (2) why would a firm change its performance weights and measures? These questions were investigated both quantitatively and qualitatively. They assessed that systematic management requires a comprehensive management control system, but that not all of it need be measurable. However, the portion that is feasibly measured should be considered for the PMM; otherwise the firm might lose valuable performance information. They cited some examples of PMMs that have been used: the DuPoint Rate of Investment (ROI) formula (this disaggregates financial performance into manageable elements), EVA (Economic Value Added) model, Otley's performance management model, APL model and the Balance Scorecard. The PMM used in this study was developed by a US equipment manufacturer for its distribution channel. The company's primary competition factors are price, quality, customer service, and speed of delivery for goods and services. The PMM used was developed internally by company employees. It was designed to focus on outcomes that the company felt was important in order to meet company goals. The authors carried out interviews with top managers and distributors to gather qualitative data and also, understand the nature of the business and the dynamic structure of the PMM. They found out that measures were chosen consistently with emerging theory but some changes to the PMM were inconsistent with an interpretation of that theory (Malina and Selto, 2003). Even though the PMM is a good measure of performance, it was not used in this study because it is not suitable for co-operatives.

Jarvis et al. (1999), in their study of performance measure set out their main objective to investigate and identify the performance measures adopted by owner-managers of small firms, exploring both the rationale for their use and the consequences of adopting such measures. They carried out this study by interviewing owner-managers on the way they assess how well their businesses were doing. They generated data from this which were sorted as qualitative data. Rather than evaluating performance against predefined objectives such as profit maximization, they used objectives actually adopted by the respondents (Jarvis et al, 1999).

Performance measurement is a key factor in ensuring the successful implementation of a company's strategy. Thus when organizations implement new strategies, they should ensure that the appropriate set of performance measures are in place to monitor these strategies (Berliner and Brimson, 1988). Performance measurement systems do not only provide data necessary for managers to control business activity, but also influence the behaviour and decisions of managers. This being the case, a restrictive set of financial performance measures may adversely impact on a firm's long-term viability, thus it is argued that firms should develop a wide range of performance measures. Some schools of thoughts on ways of assessing business performance (eg. (Hopwood and Miller, 1994) are challenging the conventional emphasis on financial measures and the rationality of dominant financial models. Hopwood and Miller argued that this emphasis on financial measures leads to uninformed decisions and less than optimum performance. For instance, Salerian (2003) argues that productivity growth and strong financial performance do not necessarily go together. Salerian indicates that there are highly productive companies that are financially weak, and

likewise, there are inefficient producers or firms that may make substantial profits because of market power.

2.5.3 Financial Ratios Studies

Financial ratios as a measure of performance have been used in some studies. This was the traditional way of measuring performance until the introduction of non-financial measures. Some studies that looked at financial ratios include a study by Parker and Hartley (1991) on ten organizations in the United Kingdom assessing the impact of organizational status changes of these firms on their financial performance. Parker and Hartley carried out this study by calculating a set of standard financial ratios which were intended to reflect the quality of management in terms of the efficient use of working capital, fixed assets and probability. The financial ratios they used were percentage return on capital employed (profitability), turnover to average net fixed assets employed per annum, stocks to turnover, debtors to turnover, labour's share in costs and value added per employee. The financial ratios were calculated for each organization over a four year period and then compared. These authors concluded that organizational status changes do not appear to guarantee improved performance nor does it necessarily worsen performance in terms of the financial ratios studied. Brown et al (1994) did a study to compare U.S. and Japanese corporate-level operating performance using financial statement data. Three primary measures of operating performance used were return on assets, profit margin and assets turnover. These were for firms from the two countries. Their results showed that neither country appears to generate systematically higher profit margins, but U.S. firms turnover assets other than inventory more quickly and therefore have higher rates of return on assets.

In his performance evaluation of Taiwan banks, Yeh (1996) examined the application of the Data Envelopment Analysis in conjunction with financial ratios to help bank regulators in Taiwan not only to distinguish the efficient banks from the inefficient ones, but also to gain insight into various financial dimensions that may link the bank's financial operational decisions. The financial ratios he selected for his study were the key ratios used by bank analysts and these included profitability, capitalization, asset equality, operating efficiency, liquidity and interest sensitivity ratios. He also estimated the DEA efficient scores of the banks in the study and then compared these scores with the financial ratios. His results showed that banks which were more DEA efficient were less leveraged and more aggressive in employing their deposits and assets to generate revenues than those who were less DEA efficient.

Sarkar and Sriram (2001) carried out a study to demonstrate how probabilistic models may be used to provide early warnings for bank failures in the U.S. In doing this, they specified an automated system to provide reliable probability estimates for early warning of bank failures. This automated system examined financial ratios as predictors of a bank's performance and assessed the probability of a bank's financial health. To do this, they used two distinct probabilistic models. The first was a simple Bayes model that assumes independence of all the predictive attributes (i.e the financial ratios) conditioned on the outcome variable. The second model used a partitioning of the attributes based on the interaction of the different financial ratios being used for prediction. The financial ratios used included return on equity, return on assets, nonperforming loans to total assets, and total operating expense to total operating income. They found that both

models used are able to make accurate predictions with the help of the financial ratios used.

2.5.4 Economic Efficiency Studies

Another aspect of performance measurement that is commonly used is economic efficiency measures. Economic efficiency measures are mainly production, cost and profit measures. The use of any one of these measures depends on the performance objectives set by the firm and the availability of data. There are many studies carried out on the efficiency of firms. There are two primary methods for estimating efficiency; the econometric (parametric) approach and the mathematical programming (non-parametric) approach. Examples of some studies that used these methods are outlined below.

Bravo-Ureta and Rieger (1991) carried out a study on dairy farms in New England to estimate their efficiency using stochastic frontiers. Bravo-Ureta and Rieger used a stochastic efficiency decomposition model to analyze technical, economic and allocative efficiency for a sample of New England dairy farms. The authors used cross-sectional data for a sample of 511 dairy farms to estimate a Cobb-Douglas stochastic production frontier. The authors concluded that mean economic efficiency for farmers in the sample is about 70% and that on average, there is little difference between technical and allocative efficiency. They also looked at the relationship between efficiency and four socioeconomic variables - farm size, education, extension, and experience. The results they obtained revealed that efficiency levels are not really affected by these variables (Bravo-Ureta and Rieger, 1991).

Wang et al. (1996), in their study to measure profit efficiency in Chinese agriculture, used a shadow-price profit frontier model. This shadow-price profit frontier

model incorporates price distortions but retains the advantages of stochastic frontier properties. These shadow prices and shadow profit are derived through a behavioural profit function. Wang et al. estimated their model using household survey data and their results showed that the conventional assumption of profit maximization based on market prices is inappropriate. The authors concluded that farmers' resource endowment and education influence their allocative efficiency. Reinhard et al. (1999) carried out a study to estimate the technical and environmental efficiency of Dutch dairy farms. To help them achieve their aim, they specified a stochastic translog production frontier. The authors used this frontier to estimate the output-oriented technical efficiency and environmental efficiency is also estimated as the input-oriented technical efficiency of a single input, the nitrogen surplus of each farm. Reinhard et al. concluded that intensive dairy farms are both technically and environmentally more efficient than extensive dairy farms.

Piacenza (2002) did a study to investigate the way subsidization mechanisms (i.e. regulatory contracts) affect the cost efficiency of public transit systems in Italy. The author estimated a stochastic frontier cost function model for a seven-year (1993-1999) panel of 45 Italian transit companies. Piacenza concluded that transit operators with fixed-price subsidies exhibited lower deviations from minimum costs. A few studies have also been done on the efficiency of co-operatives. An example is a study done by Porter and Scully (1987). Porter and Scully compared the property rights structure of proprietary firms and co-operatives in the US and the implications of these differences for cost and efficiency. The authors employed the concept of the frontier production function in order to assess efficiency differences among the various organizational forms present in the

dairy milk-processing industry. According to Porter and Scully, the frontier-production function approach permits the decomposition of efficiency into factor-price efficiency, scale efficiency, and technical or managerial efficiency. Porter and Scully concluded that the co-operatives in the dairy industry were less efficient than proprietary firms in the same industry.

Non parametric approaches have also been used in some studies to measure efficiency. Vicente (2004) carried out a study to measure the levels of technical, allocative and economic efficiency in agricultural crop production in Brazil. He used a non-parametric frontier model (i.e. Data Envelopment Analysis (DEA)) approach. The DEA method is a method of constructing production frontiers without specifying production technology. The DEA is a linear programming methodology that uses data on outputs and inputs to construct complete linear production surfaces. The frontier surface is obtained by series of linear programming problems, one for each observation. The measure of the inefficiency of each observation is given by the distance between each point and the production frontier. Using the DEA method for his study, Vicente found that the crop production sector in Brazil suffers from moderate technical inefficiency and from strong allocative inefficiency.

A study by Shiu (2002), to compare the performance of state-owned enterprises to non-state-owned enterprises compared the efficiencies of these two types of firms in China. Shiu used the DEA technique to evaluate technical efficiencies in the two groups of firms. The results showed that the state-owned enterprises performed less efficiently than the non-state-owned enterprises. Another study that used the DEA approach to measure efficiency is a study done by Singh et al (2000) on co-operative dairy plants in

India. The main aim of the authors was to examine the impact of liberalization policy on the performance of the co-operative dairy plants. Singh et al. used the DEA and the Fisher index approaches to measure economic efficiency and total productivity changes respectively. Their results showed that even though the liberalization policy had an effect on the efficiency of the plants, it is not the only answer to higher performance; plant managers should make efforts to achieve higher performance through actions on both the demand and supply side of the milk and milk products industry.

Chang (1999) carried out a study to measure risk-adjusted efficiency in Taiwan's major rural financial intermediaries using a non-parametric approach. Chang used a non-parametric production model to incorporate risk into the measurement of technical efficiencies of the major financial intermediaries in rural Taiwan. The results obtained showed that incorporating risk as an undesirable output has significant impact on efficiency. Athanassopoulos and Thanassoulis (1995) carried out a study to assess the usefulness of separating marketing efficiency from profitability when assessing the comparative performance of private sector organizational units. Athanassopoulos and Thanassoulis used DEA to assess market efficiency and profitability separately using two sets of pubs from a large brewery in the United Kingdom. Their results showed that knowing the market efficiency of a pub, it may be possible to judge better its long term viability.

Athanassopoulos (1998) wrote a paper in which he looked at the efficiency in large networks of bank branches. The author used multivariate analysis in order to ensure the homogeneity of the branches assessed and DEA for assessing efficiency. The author applied these methodologies on a sample of 580 branches of a commercial bank in the

United Kingdom. The results obtained reinforced previous claims regarding the presence of high technical inefficiencies at the branch level. Some studies also employ both parametric and non-parametric approaches to measure efficiency. Chakraborty et al (2001) used both the stochastic and non-stochastic production approach to measure technical efficiency in public education in Utah. The stochastic specification estimates technical efficiency assuming half normal and exponential distributions. For the non-stochastic specification, they used the two-stage DEA to separate the effects of fixed inputs on the measure of technical efficiency. Their results showed that there was substantial variation in efficiency among school districts. Chakraborty et al. also concluded that these measures are insensitive to the specific distributional assumptions in the stochastic specification but are sensitive to that of the two-stage DEA.

Some studies have also applied both financial ratios and efficiency measures in their estimation of firm performance. A study by Pombo and Taborda (2004) on the performance and efficiency in Colombia's Power Utilities looked at the effect of a 1994 reform in the sector. Pombo and Taborda wanted to find out the performance of the power utilities before and after the reform. The authors used profitability measures and technical efficiency measures using the DEA technique. Their results showed that both technical efficiency and profitability were positively affected by the regulatory policy. Economic efficiency measurement has been used in many studies to measure performance.

2.5.5 *Previous Studies on Performance Measurement of Co-operatives*

Having looked at various studies on firm performance measures, we will now look at some performance studies done specifically on co-operatives. Kyriakopoulos et al. (2004) in their study on the impact of co-operative structure and firm culture on market orientation and performance, measured performance of Dutch co-operatives using market indicators of firm performance (i.e. market share and relative market growth) and profit margin departing from the accounting measures used in previous studies. One conclusion was that there has been pressure for developing non-financial indicators to provide a fuller picture. The author suggests that this may be a laudable idea, but measures that have theoretically sound approaches and are not financial ratios are sometimes impractical to use because of data limitations. Also, critical stakeholders associated with co-operatives (i.e. members, management and lenders) are more concerned with financial ratios than they are with measures of economic efficiency (Kyriakopoulos et al, 2004).

However, research has consistently shown that the owner-manager of small firms pursue a range of goals as well as profit maximization (Jarvis et al., 1999). This may also apply to co-operatives. Because co-operatives have a variety of objectives, selecting business performance measures to assess the extent to which they are achieving their objectives is likely to be very difficult. Co-operatives and IOFs are generally viewed as different in a number of non-financial dimensions and therefore, performance evaluation of co-operatives should not be limited to financial comparisons with IOFs. In particular, attempts to measure success solely by financial indicators will not capture the complexity of the model that co-operatives construct for managing their business. The goals of the

co-operative include achieving a balance between competitive pressures from other firms, both co-operative and non-co-operative, which are competing for the same customers. The essential distinction from other forms of organization lies in the basic structure of property rights relating to control over resource use and residual risk generated by the firm. Because of their unique user-oriented ownership and control structure, it has been proposed that co-operatives employ different strategies than IOFs to achieve their goals, thereby leading to observable differences in performance (Katz, 1985). Also, with regards to the agency theory with co-operatives, the author notes that the use of non-financial measures for performance evaluation is consistent with theoretical work on competition in agency settings. Financial measures of performance are perceived to be imperfect and noisy signals of manager's effort. On the other hand, non-financial performance measures may better reflect the cause-and-effect relations and thus add value by reducing the noise in drawing inferences about agent's efforts. Therefore it is expected that performance measurement of a co-operative may differ from that of an IOF due to the difference in strategies to achieve their goals (Katz, 1985).

A majority of studies examining co-operative performance tend to use market-based measures, such as return on equity or indices of performance that combine accounting and market performance measures. These include; liquidity, profitability, productivity, leverage, and growth. Harris and Fulton (1996) carried out a study on comparative financial performance analysis of Canadian co-operatives, investor-owned firms, and industry norms. The methodology they used focused on comparing a number of accounting ratios and growth rates which provide insight into liquidity, profitability, leverage, and growth of a firm. Harris and Fulton concluded that co-operatives appear to

be more liquid in the short-run than the other firms. The authors also observed that although co-operatives may not theoretically hold profit maximization as their primary objective, there is little evidence to suggest that this has had a significant impact upon their reported rates of return.

The use of financial ratios alone may not be appropriate when studying co-operatives, since co-operatives do not trade stock in open-market exchanges (Fulton, 1995). Also, the different goals and business strategies of co-operatives and IOFs are expected to affect their financial performance in a number of ways. However, (Katz, 1985) argued that since productivity is a basis for competitive advantage in agribusiness, firm productivity which he defined as the average product of labour can be used to measure performance of co-operatives. Katz sought to measure the relationship between firm performance and organizational factors like firm size, ownership, financial strategies, and technological strategy. Katz used firm productivity which he defined as the average product of labour as his performance measure for agribusiness co-operatives. The author used size, ownership, and organizational strategies as independent variables. The organizational strategies were made up of diversification, financial strategy, compensation strategy, and technology strategy. With diversification, a standard industrial classification (SIC) based product count measure categorizing firms into two groups: ie related product diversification and unrelated diversification was used. Two measures of financial strategy were used to capture long-term and short-term financial strategies.

Short-term financial strategy was measured by liquidity (i.e. the ratio of total current assets to total current liabilities). Long-term financial strategy was measured by

leverage (i.e. the ratio of total long-term liabilities to total liabilities). Compensation strategy was measured by the total chief executive officer, or top manager's cash compensation expense. This was obtained from publicly disclosed annual reports that were reported directly by co-operatives in response to a mail survey. The technology strategy was measured by the ratio of total annual research and related costs as a percentage of total annual net sales. The conventional measure of technology strategy is the ratio of total annual research and development expense to total annual net sales. However, in Katz's study, research and associated administrative expenses were used based on the argument that co-operatives generally do not separate research expenses from their related administrative component. The results of the study showed that ownership affects firm's productivity directly and indirectly through the organizational strategies (Katz, 1985).

A co-operative's objective to increase the welfare of its members may lead to lower profit levels and higher liquidity ratios than IOFs (Lerman and Parliament, 1990). Low levels of member investment may cause a co-operative to be more highly leveraged. These factors can combine to have a negative impact upon the relative growth of co-operatives (Lerman and Parliament, 1990). Lerman and Parliament carried out a study to analyze the comparative performance of co-operatives and IOFs in the fruit and vegetable processing industry and in the dairy industry. The authors hypothesized that the differences in the performance of co-operatives and IOFs may be due to divergence in their objectives and strategy. Lerman and Parliament calculated financial ratios (profitability, leverage, solvency, liquidity, efficiency) of the co-operatives and IOFs from their audited annual reports from 1976-1987. For each observation year, the median

of each of the financial ratios was calculated for the two co-operative industries. To detect significant differences between co-operatives and IOFs in the two industries, time series of the median financial ratios in each industry were analyzed using the non-parametric Kruskal-Wallis test (ie "one-way analysis of variance by ranks").

The Kruskal-Wallis test is a non-parametric analogue of the one-way analysis of variance (ANOVA). This test is used to compare the medians between more than two samples when the underlying distribution is not normal. In their study, the test ranks the pooled median financial ratios in the different firm categories in each industry and forms the sums of the ranks for the pooled sample. If the rank sums, or the average scores, are sufficiently different between the IOF and co-operative categories, the test rejects the null hypothesis that the median financial ratios are the same for the two types of firms and establishes that co-operatives and IOFs in a particular industry have different financial ratios. Lerman and Parliament concluded that co-operatives in the dairy industry had comparable profitability with IOFs in the same industry.

When examining the performance of a firm, empirical testing of theories of market behaviour should be of interest to the firm. For example, how and to what extent do the characteristics of markets (i.e., buyer and seller concentration, entry barriers, product differentiation, elasticity of demand, strategic groups) affect the profitability of firms?

Co-operatives are often thought of as also providing a public good (Fulton, 1995). This includes their ability to correct for market failures by providing services which might not exist in a functioning market and also their commitment to participatory management and democratic governance. Therefore, a full evaluation of co-operative

performance would require a method that is capable of also valuing these non-market dimensions. Sexton and Iskow (1993) pointed out that analysis of performance using financial ratios only, although popular, is not based on economic theory. Furthermore, they noted that co-operatives represent the vertical integration of the producers' firms; thus it is inappropriate to evaluate performance of the whole entity by examining data for only a portion of the entity. They went on to argue that a co-operative could be less profitable than an IOF and still be desirable to a member, as long as the member's discounted stream of returns from the co-operative were greater than those from marketing the commodity directly or through an IOF (Sexton and Iskow, 1993).

Also, with co-operatives viewed as a form of collective action, their performance can be measured by estimating the incremental value of the co-operative to its members. An appropriate performance measure for an agricultural co-operative could be the profitability of the members' farming operations with and without the co-operative. Thus, the incremental value of say, a marketing co-operative can be inferred from the differences in the prices received by member producers from their co-operative and those received by producers dealing with comparable IOFs under non competitive situations (Cobia and Brewer, 1989).

When looking at profitability as a measure of performance, co-operatives, in contrast to IOFs, are seldom regarded as rate of return maximizers; ie, co-operative members may expect to receive benefits through services provided by the co-operative, such as high output prices or better marketing channels, and not through return on investment (Sven, 1992). Co-operatives thus can be expected to have lower profitability than IOFs. However, studies by Parliament et al. (1990) compared the performance of co-

operatives and IOFs within the US dairy industry using financial ratio analysis (profitability, leverage, efficiency and solvency) and found, in contrast to a priori expectations, that co-operatives had higher profitability and lower leverage than comparable IOFs. Harris and Fulton (1996) also carried out a study to compare the financial performance of co-operatives and IOFs. The results from their non-parametric statistical comparisons of profitability measures lead then to conclude that although co-operatives may not theoretically hold profit maximization alone as their primary objective, there is little evidence to suggest that this has had a significant impact upon their reported rates of return (Harris and Fulton, 1996). Thus, financial ratio analyses have been used by many people to assess the performance of co-operatives and IOFs (e.g; (Parliament et al., 1990; Lerman and Parliament, 1990; Oustapassidis et al., 1998; Baourakis et al., 2002; Bjornson and Sykuta, 2002)).

The performance of co-operatives in the Canadian economy is attracting increasing attention. The GATT and NAFTA agreements, industry structural change, and increased competition were suggested to raise concerns about Canadian co-operatives' ability to compete and survive (Harris and Fulton, 1996). Also, an important aspect of co-operatives' ability to form, compete, attract capital, and provide services to their members is their operating performance. One of the main objectives of co-operatives is to avert market failure (Fulton, 1995). But are they really pro-competitive forces acting to improve market performance and increase welfare, or do they represent an inefficient and possibly monopolizing form of organization? Are marketing co-operatives profitable and efficient under supply management?

Profitability of an IOF may affect its ability to grow by both internal and external means. The more profitable the IOF is, the more rapidly it can grow from retained earnings. In addition, high profitability may be interpreted by potential investors as an indication that the future earnings of their investment will be high and safe. The IOF may be able to obtain capital on more favourable terms. However, in a short-run period it is reasonable to expect that the IOF may allocate part of its profits in investments to secure its establishment and growth in the market. Therefore, either a positive or a negative relationship could be obtained between growth and profitability depending on the strategy of the firm and also whether it is a co-operative or an IOF. The case of the co-operative is different. A very fundamental co-operative principle is "operation at cost" (Caswell and Cotterill, 1988). Therefore, co-operatives are not expected to make profits, and if any revenues are realized over and above costs they are to be distributed to members as dividends according to patronage. The main source of funding for co-operatives is through debts and retained earnings. Co-operatives in their bid to retain earnings to finance their growth may be seen as not maximizing the welfare of their current members.

Also, co-operatives have been hypothesized to be inefficient relative to investor owned firms for a number of reasons. Porter and Scully (1987) and Ferrier and Porter (1991) argue that co-operatives will be technically inefficient because of principal-agent problems relating to difficulties in monitoring performance. Because co-operative stock is not transferable, no convenient performance measure exists for co-operatives, and also, because ownership is usually among many members, individual members have little

incentive to monitor performance of the co-operative. Staatz (1984) agrees with this argument.

Porter and Scully (1987) further argue that co-operatives will exhibit allocative inefficiency because of horizon problems. That is because members benefit from co-operative investments only over their horizon as patrons, it is hypothesized that co-operatives will under-invest in long-term assets such as capital. Porter and Scully again argue that co-operatives often lack sufficient patronage to achieve the cost minimizing scale of operation and thus exhibit scale inefficiency. However, other arguments can also be raised to suggest that co-operatives will perform more efficiently than investor owned firms. These derive from possible cost savings to internalizing transactions through vertical integration. Vertical integration eliminates the problem of technical inefficiency. Co-operatives provide mutual vertical integration for their members.

Statistical methodologies to conduct efficiency tests are available as are non-parametric programming approaches. The major difficulty, however, in conducting tests based on technical, allocative and price efficiencies is availability of data (Csaki and Yoav, 1993). In carrying out these tests, cost and output data are required for several co-operatives. And such data are generally confidential and co-operatives are not willing to give them. In the U.S. for instance, the only industry offering the potential for analysis based on data availability has been the dairy industry.

Another aspect of performance measurement that can be looked at is economic efficiency. Certain types of economic inefficiencies like allocative inefficiencies are often referred to as X-inefficiencies. Given the limited number and scope of co-operative efficiency studies conducted to date, opportunities to draw solid inferences from them

alone is minimal even if they reached a consensus of opinion. In dairy industry studies, both Porter and Scully, using a statistical frontier production function approach and Ferrier and Porter, analyzing the same data with a programming approach, conclude that co-operatives are comparatively less efficient than investor owned firms. Babb and Boynton (1981) and Parliament et al. (1990), employed different analytical methods and reached opposite results. Hailu (2005) explored the cost structure and cost efficiency of supply and marketing co-operatives using random parameters stochastic frontier models. The parameter estimates of the cost frontier and the resulting cost efficient scores indicated that there are statistically significant cost inefficiencies in all categories of co-operatives. This study also found a negative relationship between financial leverage and cost efficiency. This, according to Hailu (2005), may be attributed to the fact that leverage may raise agency costs. Other schools of thoughts think otherwise. Jensen (1986) argues that leverage may also increase the pressure on managers to perform, because it reduces the moral hazard behaviour by reducing 'free cash flow' at the disposal of managers. This suggests a possible positive relationship between efficiency and leverage.

2.6 Supply Management Effects

Supply management in the Canadian dairy and poultry sectors has been the subject of considerable debate (Schmitz and Schmitz, 1994). Despite many similarities in terms of markets, tastes, standards of living, resources, technology, education, and political orientation, Canada and the United States have quite different patterns of agricultural transfer programs. One prominent feature of Canada's complex agricultural

policy is the emphasis on mandatory marketing programs, such as supply management. Canadian and U.S. agriculture is heavily protected and subsidized by the public through high food prices and public expenditures. Although consumer and taxpayer input may be a recognized and perhaps increasing component of American agricultural and food policy, agricultural production interests continue to dominate policy. For instance, public debate about the Canadian Farm Products Marketing Agencies Act, which provided for wide-reaching supply management policies that would greatly increase the cost of food in Canada, contained no major input from consumer and agribusiness interests (Schmitz and Schmitz, 1994).

What would have necessitated the establishment of regulatory bodies? The public interest theory of economic regulation has enjoyed wide implicit support from academicians and rhetorical support from policy makers. This theory is based on two assumptions: first, markets are fragile and tend to operate inefficiently; and second, government regulation is costless or, at least cheap (Posner, 1974). Thus, regulation may be said to be the end result of a public response to some market inefficiency or inequity and is implemented to benefit society as a whole, or perhaps some important subset of society. Reasons for intervention (in this case, supply management) may include destructive competition, structural imperfections, inadequate information, externalities, income distribution goals, agricultural fundamentalism and self-sufficiency goals. The regulated marketing system allows for the legal formation of cartels that strengthens the bargaining power of producers in the marketplace. Under supply management, restrictions of farm products and imports are used to achieve target producer prices.

According to Spriggs and Van Kooten (1988), there are three basic objectives of regulatory policies:

- To bring stability to industries that previously had experienced large fluctuations in price and/or production – that is, to stabilize prices and incomes of producers;
- To maintain and increase producers' incomes through higher prices, lower costs or expanding sales; and
- To meet a variety of implicit or explicit political and social objectives.

There are two main welfare benefits that may be derived from stabilization of prices or income. The first is that stabilization contributes to economic welfare by off-setting economic inefficiencies that arise from price instability. The second is that price or income stabilization provides greater stabilization of producers' family consumption activities.

When considering the effects of supply management, certain factors will have to be considered. For example, there are additional costs associated with 'rent seeking'. Costs are also incurred in actually carrying out and administering the supply management system. These include not only government personnel, but also the many marketing board employees employed in the industry. Also, inefficiencies are created by the lack of interprovincial trade.

2.6.1 Canadian Price Trends

It has been argued that due to supply management, producers become better off because supply management gives them some degree of monopoly power. This monopoly power makes consumers worse off since the prices they pay for food products

are higher than they would have been under competition. While there is price variability, it is less than that which would exist without supply management (Coffin et al., 1989).

One question that remains is "would consumer prices be lower without supply management?" Generally, the critics of supply management argue that the industries are inefficient and consumers are paying too high a price for commodities that are produced under supply management regulations. Another area of criticism of supply management is on the lack of interprovincial trade and the setting up of provincial production quotas by supply management committees (Hollander, 1993). Supply management has also been criticized as being trade restricting, since it requires import quotas for successful operation. There have been proposals for the reform of the supply management system in two task force reports (Task Force on National Dairy Policy 1991; National Poultry Task Force 1991). Analysts, especially academic economists have been negative on supply management (Schmitz and Schmitz, 1994). This may be largely due to the social regressiveness of the instrument.

All studies reviewed by Schmitz (1983) showed that there is a sizeable income transfer from consumers to producers along with a misallocation of resources as a result of supply management. Schmitz, after reviewing studies done by four different authors, namely, (Harling and Thompson, 1983; Barichello, 1981; Areus, 1978; Veeman and Veeman, 1978), came to the general conclusion that supply management results in a misallocation of resources (although the degree may be small) because too many resources are committed to the respective industries.

2.6.2 Quota Value

One element of supply management is that the rights to produce these commodities, the quotas, have become very valuable. Under the supply management system, farmers need production quotas to produce milk, broilers, eggs, turkeys, and hatching eggs. Quota values may depend on many factors, which include technological change, price risk, subsidized credit for the purchase of quota, and economies of scale. However, the key to supply management is the use of import quotas and domestic production controls (Vercammen and Schmitz, 1992). There is an open question of what rule regulators use to set the production quota. One of the most important considerations when modeling the effects of supply management is deciding at what level to set the production quota.

Currently, quota values are at a record high and are assumed to represent over half of the total farm investment. While quota is traded at market values in all supply-managed commodities, it is only in dairy that official records acknowledge and track these values. The value of quota as of June 2001, based on 1 kilogram of butterfat, was calculated at $52.20 in BC, $60.46 in Alberta, $49.04 in Ontario and $65.48 in Quebec (Ministry of Agriculture, Food and Fisheries, Quebec, 2002).

The value of quota will be influenced by a number of economic factors. One basic factor is the profitability of the sector based on its productive value. In economic terms, the value of a quota reflects the capitalization of an expected stream of income (profit) over time; the more profit that is expected the higher the value of a unit of quota. Hence quota value will increase both as a result of efficiencies gained through use of improved technology and economies of size. A second possible influence is the expectation of capital gain or the speculative value of quota: this suggests that quotas have always

increased therefore they will be worth more in the future. A third expected influence is profitability of alternative investments. Currently interest rates are relatively low when compared to alternative investments, i.e., Guaranteed Investment Certificates or Bonds, the escalation in quota value suggest that this is a more attractive investment. Another influence may be available financing. With relative stability and profits in the supply-managed sectors, financial institutions appear to have been willing to provide more financing (accepting higher lending ratios) over longer terms, hence creating more liquidity that would tend to bid up quota values.

2.6.3 Effect of Supply Management on Producers and Consumers

The existence of supply management suggests that producers are relatively powerful politically, and it seems unlikely that the domestic production quota would remain unchanged in the face of changes in imports and prices. It is conceivable, for instance, that domestic production might fall by an amount greater than the increase in imports, reversing the effects on price and consumer welfare that would follow from introducing a minimum access requirement (MAR) with fixed production. With endogenous quotas, tariffication might lead to a worsening of distortions from either a domestic or a global perspective (Alston and Spriggs, 1998).

Statistical evidence suggests that supply management raises the price of milk beyond free market prices. From 1990 to 2000, all prices as measured by the Consumer Price Index rose by 21.7%. A study by Van Kooten (1988) to determine the loss in consumer welfare due to the establishment of marketing boards in poultry, eggs and dairy found that the supply-restricting prices in poultry and eggs are 22% and 33.9%, respectively, above their unregulated values. From a cost and benefit perspective, several

important empirical studies have been done on the effects of supply management. An example is Barichello (1982). Barichello provided empirical estimates for the egg, broiler and dairy industries and these showed that there were consumer losses. The greatest consumer cost occurred in the dairy sector and producer gains were significant. Josling (1981) also made estimates of the costs of the dairy program. Josling also found similar results for producers, but he concluded that the consumer costs were much smaller than those reported by Barichello. In both cases producers also gained significantly as a result of supply management. There has, however, been considerable debate over the costs and benefits of supply management.

2.6.4 Effect of Supply Management on Processors

Although regulatory environments have effects outside the producer and consumer sectors, these effects have not been the direct subject of research by most agricultural economists. Regulatory environment should be studied in relationship to the entire competitive framework, which includes their effects on processors. With regards to processors, producers and consumers, the effect of supply management can be seen to be mostly amongst processors. Producers must supply a fixed amount of produce. Producers might want to supply more produce to processors but they cannot do that under the supply management system. Also, the price that processors pay to producers are fixed, thus processors cannot pay less than the fixed price. It is therefore up to the processor to lobby for more produce from other producers. And since all other processors are competing for a fixed amount of produce from producers, there may be strong competition among processors.

According to Funk and Rice (1978), the integration of agribusiness firms with other sectors of the broiler industry in Ontario had declined and they attributed this situation to the supply management board's restriction on the accumulation of quota under one owner on one premise. In addition there was reduced profitability of the processing sector which made potential investments very unattractive. In the same study, it was found out that while the feed companies and most hatcheries reported increased gross margins after the introduction of the marketing board, all processors reported decreased gross margins. They attributed the increase in gross margin for the hatcheries and feed companies to the improved financial situation of producers brought about by the policies of the marketing board. The decrease in gross margins reported by processors was also attributed to certain policies of the marketing board, particularly those related to pricing. Given the pricing formula used by the board to establish live broiler prices, most processors reported a decrease in gross margin because the processors are positioned between a relatively inflexible, cost of production determined price for their inputs, and a downward, flexible, market-determined price for their processed products. In addition to this, the processors assessed that because of the board's restrictions on production through its quota allocation decisions, their fixed costs are spread over a much smaller volume of output resulting in significantly higher unit operation costs (Funk and Rice, 1978).

Another problem processors have with some marketing boards is that the marketing boards take no responsibility for marketing of products after they have been picked up at the farm by the processors, despite the fact that the board sets production levels and prices which have significant impacts on the availability and retail prices of the

final product. On the issue of technology and capacity, processors assessed that with the introduction of marketing boards, there is lack of market growth and inadequate margins and this has led to the slow adoption of technology. Capacity utilization is also found to be affected adversely by the policies of the marketing board. Processors are operating below the desired capacity (Funk and Rice, 1978).

In their early study on the effects of the Ontario Chicken Producers' Marketing Board on the agribusiness sector, Funk and Rice (1978) looked at the board's effect on risk. The authors concluded that the supply management policy has caused a transfer of risks from the production sector to the processing sector, without any risk premium for the processing sector. According to them, the broiler producers assume the least amount of risk. Because the producers many times sign contracts with processors before undertaking production, they are assured of a market for their product; and because their product is priced on the basis of a cost-of-production formula, they are assured that the price they receive will normally cover at least their production costs plus an allowance. As a result, Funk and Rice (1978) indicate the only economic risks producers may face are associated with the value of the quota they own. Processors, on the other hand, are argued to have assumed substantially more risks as a result of the marketing board, since then processors contracted for their supplies long before production due to competition with other processors without knowing, first, the price the board would set in the week the produce will be delivered; second, the percentage of basic quota which will be in effect at that time, hence the exact amount of produce they would be obliged to purchase and third, the demand for the products at the time of processing. Thus Funk and Rice

(1978) concluded that processors assumed major economic risks in that regulatory environment.

The dairy processing industry makes a major contribution to the Canadian economy with shipments valued at about $11.5 billion in 2004 (Canadian Dairy Information Centre, 2005). Second only to the meat processing, the dairy processing sector accounts for approximately 15.2 percent of the estimated value of all food and beverage industry shipments. The dairy processing industry ranks fourth in the agri-food sector. Major adjustments have been observed in the dairy industry (Barichello, 1996). The Canadian dairy processing industry has seen significant rationalization over the past decades. Some companies have shut down and others have merged to become more competitive and productive. This downward trend has been continuing for many years now but has accelerated since the 1990s. From 1965 to 2005, the number of dairy plants has gone from 1,413 to 459 (Agriculture and Agri-Food Canada, 2005). Of these 459 dairy plants, 33 are co-operatives. The market share of the dairy co-operatives was 42% in 2002 (Co-operatives Secretariat, 2004). What role does supply management play in this trend in the dairy industry?

The poultry processing industry in Canada has realized substantial gains, increasing from approximately $1.9 billion in 1988 to about $3.8 billion in 2000 (National Farm Products Council, 2005). The value of sales from the entire egg processing industry in 2000 was estimated at $100 million, a 29 percent increase from 1997 (Agriculture and Agri-Food Canada, 2003). A report by USDA on international egg and poultry review notes that with rising demand by food processors, Canada's egg processing industry now absorbs about 20 percent of total Canadian egg production (U.S.

Department of Agriculture (USDA), 2000). The report concluded that the expansion of Canada's egg processing industry has resulted in sharply increased demand for processing eggs that is challenging the production and pricing structure of Canada's supply-managed egg industry. Have the sales values in the poultry and egg processing industries been the result of supply management in these industries? Or would their performance have differed without the supply management system?

One study that has looked at the effect of supply management on the industries operating under it is the study done by Janmaat (1994). His main objective was to examine the performance of the dairy co-operatives with respect to their investor-owned counterparts in the dairy industry. He used the capital asset valuation model to examine the relationship between supply management quota and the expected success of the co-operative. The variables he used as a prediction of the success of a co-operative were the consumer price of milk and the rate of return generated by the Toronto Composite 300 (TSE 300) index. The outcome of the estimation showed that the price of quota is positively related to the consumer milk price and the TSE 300 price. His results showed that supply management may effectively affect the operations of dairy co-operatives. The trends in these supply-managed sectors are therefore worth studying to ascertain the probable causes.

2.7 Summary of the Chapter

The principles and theory of co-operatives and how they affected the behaviour of co-operatives were reviewed in this chapter. The economics and marketing strategies of co-operatives in general and marketing co-operatives in particular were examined. Firm performance; studies done on firm performance in general, performance of co-operatives,

regulation and performance, and various types of performance measurements were also reviewed. It is clear that many studies have assessed investor owned firms and less attention has been directed to co-operatives. The performance measures used in previous studies varied from financial ratios to efficiency frontiers, with financial performance measurement being a popular measure among the studies reviewed. Throughout the review, it was realized that performance measurement based solely on financial ratios have been criticized. Fisher and Gowan (1993) defended the use of financial ratios, arguing that provided the financial ratios are corrected for risk, they are suitable for economic analysis. Some performance studies done on co-operatives also used financial ratios (e.g. (Parliament et al., 1990; Lerman and Parliament, 1990b; Harris and Fulton, 1996)). From these studies, it can be inferred that financial ratio analysis may be used for co-operative performance measurement, but care must be taken with the choice of variables when dealing with co-operatives to recognize their particular structure and objectives. The study by Jarvis et al. (1999) suggests asking the managers of co-operatives the indicators they would use to assess the performance of their co-operatives. However, this query should be put to directors and members. A survey of that nature was not conducted in this study due to the limitation of time and resources.

Economic efficiency measures as an indicator of performance were overviewed in this chapter. Economic efficiency measures include production, cost and profit efficiency measures. Most of the studies done on efficiency looked at production and cost efficiencies. Most studies done on profit efficiency are seen in the banking sector. Efficiency studies for co-operatives have looked at the production and cost aspects of efficiency. Thus, this study will analyze the profit efficiency of marketing co-operatives.

Supply management, how it works and its effects were also reviewed. It was found that consumers are probably paying more than they should under supply management (Barichello, 1982). Producers on the other hand may be gaining from supply management (Van Kooten, 1988). Funk and Rice (1978) assess that processors are the most affected by supply management. Processors may have reduced profitability and be prone to higher risk due to supply management.

Having reviewed the literature on many performance measures, this study will, in the next chapter develop two performance measurements; First, following Katz (1985), financial performance measurement using financial ratio analysis. Even though some studies have identified some problems with financial ratio analysis, it is still a plausible measure of performance for co-operatives because most of the non-financial indicators of performance do not apply to co-operatives and therefore cannot be measured. Based on the study by Katz (1985), financial ratio analysis is carried out in this study using some of the variables he used like firm size and membership size.

Also following Harris and Fulton (1996), the study carries out a comparative financial performance analysis of supply-managed and non supply-managed co-operatives. The difference between their work and what is done in this study is that the measure in this study applies parametric comparison of individual co-operatives within and across sectors. Following Lerman and Parliament (1990), the Kruskal-Wallis test is carried out in this study to compare the financial ratios of the co-operatives.

The second measure is economic efficiency using the stochastic profit efficiency frontier approach.

3.0 CHAPTER 3: CONCEPTUAL AND THEORETICAL FRAMEWORK

3.1 Introduction

As discussed in the previous chapter, performance measurement of marketing co-operatives in this study will be carried out using financial ratio analysis and the profit efficiency frontier (which can be modified to take into account the objectives of a co-operative if market structure parameters suggest that co-operatives are major players). These measures will be used to attain the objectives set for the study which are (1) to compare aspects of the performance of marketing co-operatives in sectors that are supply-managed and those that are not and (2) to examine what the implications might be for producers and consumers with marketing co-operatives under the regulatory environment or without. The basis of the financial ratio analysis and the profit efficiency frontier will be outlined and developed in this chapter.

Financial ratios contribute to the understanding of a firm's business strategy. Financial ratio analyses are applied to various corporate appraisals and are also used for strategic management to address the future survival of the firm. Information for these analyses can be obtained from the balance sheets and financial statements of the firm. The use of financial data can provide analysis of the behaviour and relative competence of rival firms within the industry and this may help a firm to know its competitive position. The five commonly used categories of financial ratios are presented in this chapter. The various factors that affect firm financial performance are also identified and

discussed. A conceptual model is derived from these variables and subsequently, the empirical model that is used to analyze financial performance is determined.

Economic efficiency can also be used to assess the performance of marketing co-operatives in this study. Economic efficiency based on a profit function measures how close a co-operative is to producing the maximum possible profit given a particular level of input prices and output prices. Previous studies on profit efficiency are also reviewed in this chapter. A suitable functional form is chosen based on availability of data and the flexibility of the functional form.

The chapter is divided into two main sections. Financial ratio analysis and the various types or groups of financial ratios are reviewed in the first section. The use and importance of each financial ratio and how it is calculated are also outlined. Based on these financial ratios and factors that might affect these financial ratios, conceptual and empirical models of the financial ratio analysis are developed. The factors that may affect these financial ratios are also reviewed. In the second section, studies on profit efficiency are reviewed. The profit efficiency model is then derived and a functional form that will be used is specified.

3.2 Financial Ratio Analysis

Sexton and Iskow (1993) pointed out that financial analyses as measures of performance, although popular, are not based on economic theory. They argued that for instance, a co-operative could be less profitable than an IOF and still be desirable to a member, as long as that member's returns from the co-operative were greater than those from marketing the commodity directly or through an IOF. Even though these criticisms

about financial ratios may be valid, theoretically sound approaches are often impractical to use because of data limitations. Some of the theoretically sound approaches according to Moers (2000) and Mattila and Ahlqvist (2001), are non-financial measures reflecting market performance, quality, productivity and resource utilization. An example of non-financial measures is economic efficiency. Financial ratios are common in business analysis but they have not previously often been applied to agribusiness firms. Exceptions are in studies by Fulton (1995) and Parliament et al. (1990) comparing investor owned firms and co-operatives. This study will analyze both financial measures (financial ratios) and non-financial measures (economic efficiency) and compare the results.

Financial ratio analysis can contribute to the understanding of a firm's business strategy. The balance sheet of a co-operative normally represents the assets, liabilities, member equity, and volume of business of the co-operative. The use of financial data provides the analysis of the behaviour and competence of rival firms within the industry and this may help a firm know its relative competitive position. No one single ratio completely encapsulates the overall performance of a firm. Evaluations with financial ratios therefore involve analyzing several of the ratios in combination. Analysts must examine a mix of financial ratios from different categories. Five commonly used categories of financial ratios (Kamssu, 2000), include:

1. Liquidity or Short-Term Solvency Ratios:

These measure the firm's ability to meet its short-term financial obligations. In general, these obligations are normally due within one year. These ratios also indicate the ease of turning assets into cash. The various measures of liquidity ratio are as follows:

(a) **Current Ratio**

This ratio is one of the best known measures of financial strength. It is calculated as

Current Ratio = Total Current Assets / Total Current Liabilities.

This ratio tells whether a firm has enough current assets to meet the payment of its current debts. It measures the number of times that the firm would be able to pay the short term liabilities that are outstanding, if they all had to be paid now. A generally acceptable current ratio is 2 to 1 (Investing for Beginners, 2005).

(b) **Quick Ratio**

This ratio is also known as acid-test ratio. It is given by;

Quick Ratio = Cash + Accounts Receivables / Total Current Liabilities

This ratio helps to know whether a firm can be able to meet its current obligations with the readily convertible quick funds on hand should all its sales revenues disappear. A ratio of 1:1 is considered satisfactory (Investing for Beginners, 2005).

(c) **Working Capital**

Working Capital is more of a measure of cash flow than a ratio. It is calculated as;

Working Capital = Total Current Assets – Total Current Liabilities

Of the above liquidity ratios, the higher they are, the better, especially if the firm is relying on creditor money to finance its assets (Investing for Beginners, 2005).

2. Asset Management or Activity Ratios:

These measure the ability of the firm to manage its investments in assets. These ratios also measure a firm's ability to convert different accounts within its balance sheets into cash or sales. They indicate how efficiently the firm is using its resources. These

ratios are also known as turnover ratios. The various measures of activity ratio are as follows:

(a) **Stock Turnover Ratio**

This ratio shows the efficiency with which a firm manages its stock levels. This is given by:

Stock Turnover Ratio = Cost of Sales / Stock.

The higher the stock turnover the better, because money is tied up for less time in stocks. A quicker stock turnover also means that the firm makes its profit on the stock quicker, and so the firm should be more competitive. However, this will vary between industries and so it is important to compare within an industry. This ratio may not be an appropriate measure for co-operatives because co-operatives do not trade in stocks (Investopedia, 1999).

(b) **Fixed Asset Turnover Ratio**

This ratio also measures the efficiency of a firm in using its fixed assets to generate sales. The higher the level of sales generated by each unit of fixed assets, the more efficient the firm might be. This ratio is calculated as;

Fixed Asset Turnover Ratio = Sales / Fixed Assets

3. Financial Leverage or Long-Term Solvency Ratios:

These measure the extent to which the firm relies on debt financing. These ratios emphasize the long-term commitments to creditors and indicate a firm's capability to meet not only long-term but also short-term debt obligations. They also indicate how

willing a firm is to support future growth (Ross et al., 1995). The various measures of leverage ratio are as follows:

(a) **Debt to Equity Ratio**

This ratio is a measure of what proportion of a firm's equity and debt it uses to finance its assets. A higher debt to equity ratio generally means that a firm has been aggressive in financing its growth with debt. Debt to equity ratio averages run from about 25% to 200% depending on the industry (Deal, 1997). For manufacturing and other highly intensive capital industries anything approaching 100% should be viewed with caution. Theoretically there is no upper limit but any business with too much leveraged capital certainly runs the risk of being overextended. The higher this figure, the higher the risk though it can be argued the higher the potential return on investment as well (Investopedia, 1999). This ratio can be calculated as follows;

Debt to Equity Ratio = Total Debt / Total Equity

This ratio may be appropriate for co-operatives because co-operatives have equity and so calculating this ratio may be feasible Investopedia, 1999).

(b) **Debt Ratio**

This ratio that indicates what proportion of debt a firm has relative to its assets. It is calculated by dividing total debts by total assets. A debt ratio greater than 1 indicates that a firm has more debt than assets, and a debt ratio less than 1 indicates a company has more assets than debt (Investopedia, 1999). Used in conjunction with other measures of financial health, the debt ratio can help investors determine a firm's level of risk.

Debt Ratio = Total Debt / Total Assets

4. Profitability Ratios:

These measure the extent to which a firm is profitable. These ratios show the combined effects of liquidity, asset management, and debt management on operating results by measuring how effectively a firm's management generates profits on sales, assets, and stockholders' equity (Investing for Beginners, 2005). Profitability ratios are said to be the most important financial ratios in financial statement analysis even though liquidity ratios have a longer history in the credit oriented early phases of financial analysis (Investopedia, 1999). Profitability is regarded as earnings generated in relation to the resources invested in a firm's activities. When determining firm profitability, firm effects are more important than market effects (Investopedia, 1999). Peltzman (1977) expressed the view that profitability is determined by firm-wide management practices, but not necessarily by differences in market share.

A popular measure of profitability is profit margin. Profit margin is a measure of a firm's operating efficiency (Ross et al., 1995). Firms that exhibit higher profit margins are more efficient in their conversion of sales into income. Profit margin has been shown to be an appropriate measure of a firm's performance (Child, 1974). Stanwick and Stanwick (1998) used the profitability ratio as the measure of financial performance. The various measures of profitability ratio are as follows:

(a) **Net Profit Margin**

This ratio shows the proportion of the sales revenue that is profit. The profit margin tells how much profit a firm makes for every $1 it generates in revenue. Profit margins vary

by industry, but all else equal, the higher a firm's profit margin compared to its competitors, the better (Investing for Beginners, 2005). This ratio is given by;

Net Profit Margin = profit after tax / sales

(b) **Return on Total Assets**

This ratio shows the return that is made on all of the assets that the firm is using. It is also a measure of how good a firm is at obtaining earnings out of the assets employed in its business. The higher this ratio, the better. In general, a return of 12% is adequate and a return of 16% or more is considered good (Global-Investor, 2005) It is given by;

Return on Total Assets = Operating Profit / Total Assets

(c) **Return on Capital Employed**

This ratio assesses the effectiveness of the assets that are financed by long-term lenders and shareholders. This ratio should always be higher than the rate that the company borrows at, otherwise any increase in borrowings will reduce shareholders' earnings (Investopedia, 1999). It is calculated by;

Return on Capital Employed = Operating Profit / (Total Assets – Current Liabilities)

(d) **Return on Equity**

This ratio looks at the firm's performance purely from the shareholder's point of view (in the case of co-operatives, the shareholders are the members). It shows the ratio of the profits to which the members in a co-operative are entitled to, to the amount of money which the shareholders have contributed to the firm. A firm that has a high return on equity is more likely to be one that is capable of generating cash internally. For the most part, the higher a firms's return on equity compared to its industry, the better. It is calculated as;

Return on Equity = Net Income (or Profit after tax) / Equity

5. Market-Value Ratios:

They measure the financial market's evaluation of a company's performance. These ratios are thought to be more 'complete' in the sense that they indicate the true value of the firm's securities as assessed by the market (Investopedia, 1999). Several authors have concluded that market-based measures of firm performance differ from operation-based performance measures and some authors go as far as to suggest utilizing both measures if possible (Hoskisson et al., 1993; Keats, 1990). Two commonly cited ratios to measure market performance of a firm are the price-to-earnings ratio (P-E ratio), and the market-to-book ratio (Chaganti and Damanpour, 1991). Arguments have been made that the best measure of firm performance is the value the stock market places on a firm (Oswald and Jahera, 1991). Co-operatives do not trade in the stock market. Thus, this measure of firm performance (i.e. the market-value ratios) may not be suitable or appropriate for co-operatives.

The relationship between market structure and profit performance can be addressed in reference to the structure-conduct-performance paradigm. This paradigm says that industry structure variables (e.g. concentration or the number and size distribution of firms in an industry) influence the firm's strategy or conduct (the way in which the firms in that industry interact) and eventually affect its performance (i.e. profitability). Slade (2003) noted that academics from this structure-conduct-performance tradition have claimed that market structure is principally influenced by technological factors such as economies of scale and scope, and that the existence of high profit levels in an industry may be evidence that the firms in that industry possess monopoly power.

According to Slade, studies have regressed average profit rates on a number of market-wide variables such as indices of horizontal concentration, measures of economies of scale and other barriers to entry, R&D and advertising intensities. Slade noted that the relationship between market structure and firm profitability was generally found to be positive but not necessarily strong.

As stated earlier on in the review in Chapter Two, for co-operatives, their primary aim is the welfare of its members (i.e. profit maximization and producer welfare). In measuring member welfare, there must therefore be an indicator to capture producer welfare in the analysis. The analysis of financial ratios might therefore differ for co-operatives and investor-owned firms. Looking at the various measures just discussed, it is realized that some of these measures may not be appropriate for co-operatives given the nature of their operations. Based on this, the financial ratios that will be used in this study are the net profit margin for profitability, current ratio for liquidity and debt to equity ratio for leverage. These ratios will best capture the operations of the co-operatives and give a true representation of the finances of co-operatives. Following the literature, these are the most widely used financial ratios in analyzing the financial performance of co-operatives (Parliament et al., 1990; Fulton, 1995; Harris and Fulton, 1996; Hardesty and Salgia, 2004).

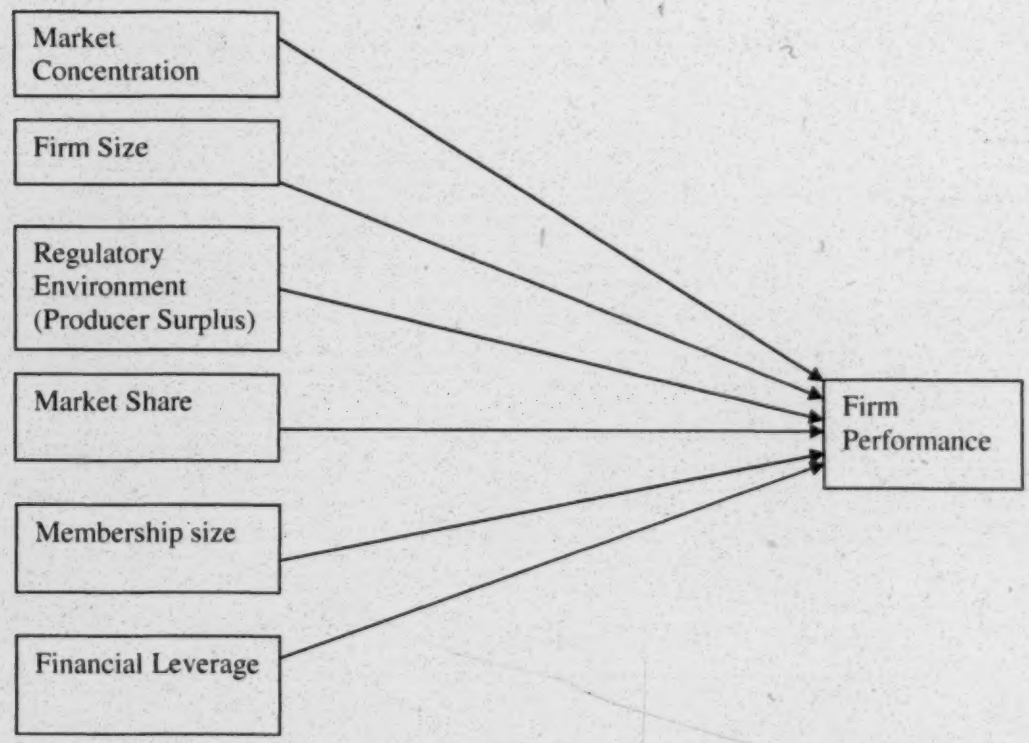
3.2.1 The Conceptual Model of the Financial Ratio Analysis

Given the financial ratios that will be used in this study (as discussed in the last section), differences between the financial performance of regulated and non regulated co-operatives can be assessed with panel data of aggregated financial ratios in each sector

using simple linear regression with the financial ratio as a dependent variable and various explanatory variables. Significant differences across co-operatives are tested using the non-parametric Kruskal-Wallis test.

A conceptual model is developed based on linear regression. In this model, certain variables postulated as affecting firm performance particularly in the context of co-operatives are specified. The financial ratio is postulated as a function of these variables. We follow a study by Fama and French (1993) on the effect of common risk factors on the return to stocks and bonds. Fama and French used a time-series regression approach to regress returns to stocks and bonds on factors like size, book-to-market equity and term-structure risk factors in returns. In this light, a conceptual model for financial ratio analysis is specified in Figure 6. Following the time-series regression approach used by Katz (1985), Fama and French (1993) and Slade (2003), a similar model is proposed but there are differences in the variables that are used in this study. The conceptual model for this study is portrayed in Figure 6, showing a regression of current ratio and profit margin on firm size, membership size, financial leverage, market share, input price and market concentration. The description of these variables and how they were determined are described in Chapter Four.

Figure 6: Proposed model of variables that affect firm performance



The basic analysis can give a picture of how the factors specified above affect co-operative performance. The regression analysis will assess what extent the performance of the co-operatives is affected by the postulated variables. Comparing across firms in different sectors can provide a clue to how the regulatory environment might affect performance.

3.2.2 Methods of the Financial Ratio Analysis

The first step of estimation in the study consists of computing financial ratios from the data set available. The descriptive statistics (i.e. mean, standard deviation, maximum and minimum values) of the variables are also calculated. Once calculated, the

financial ratios are compared to assess how the performance of co-operatives in regulated and non-regulated sectors may or may not be different. An ordinary least squares regression is performed to determine the impact of variables on each financial ratio to see if there are differences in key explanatory variables between regulated and non-regulated sectors. A multiple regression analysis is performed with one financial ratio (eg. profit margin) at a time as the dependent variable and firm size, regulation indicator, membership size, concentration, and producer welfare as independent variables.

3.2.3 Measures

The variables used in the financial ratio analysis are discussed below. These variables were obtained from the dataset used in this study. The dataset is described in detail in Chapter Four.

(a) Firm size

For an investor-owned firm, firm size can be an important variable affecting stock returns. Larger organizations tend to be less risky and more trusted by lenders and investors since the organizations own more assets that can be sold to compensate for the organization's debts (Kamssu, 2000). Fombrun and Shanley (1990) concluded that larger firms had higher value due to their size and reputation. Stanwick and Stanwick (1998) confirmed that larger firms receive a higher level of attention from the general public, which in turn may encourage the firm to have a higher level of performance.

However, Fama and French (1993; 1995) report a negative relationship between firm size and average returns. That is, for the sample they studied large firms tended to have a lower return. Katz (1985), Loughran (1997), Zaher (1997), and Elfakhani et al (1998) all confirm the results of Fama and French. Therefore, using the rationale given by

Fama and French, it can be presumed that there will be a negative relationship between firm size and average return because size is related to profitability. Total assets have been used in previous studies as a proxy for firm size (Titman and Wessels, 1988 ; Chung, 1993; Ozkan, 1996; Panno, 2003). In this study, total assets are used as a proxy for firm size. The a priori expectation of the sign on firm size is negative based on previous research. The total assets of the co-operatives used in the financial ratio analysis are presented in Tables 60 - 65 in the Appendix to Chapter Three.

From the descriptive statistics of the total assets of the co-operatives, it is seen that the standard deviations of this variable for the individual co-operatives are very large. This may mean that the asset base in each sector is different. The tables also present the minimum and maximum total assets values of the individual co-operatives. The asset base of both regulated and non-regulated co-operatives have increased across the study period. In all the sectors assets have grown, but the level of assets is different across sectors.

(b) Regulatory environment

Some studies have been carried out on the effect of regulation on the performance of firms. Most of the results of these studies have been inconclusive (Mahon and Murray, 1981). In this study, performance of co-operatives in the regulated sector is estimated separately from that of co-operatives in the non-regulated sector. Assuming the conditions available for both groups are similar, the results obtained from co-operatives in the regulated sector may be partially attributed to the effect of the regulatory environment or trade barriers. This assumption may not hold since the co-operatives are in different sectors.

(c) Market Share

Market share is the proportion of total market or industry sales held by an individual co-operative. Market share may be expressed either in unit sales or dollar values. In general, attaining the highest market share is a desirable objective. Regardless of the price of a co-operative's product, the co-operative will remain more profitable than its competitors if it has a higher market share. The market share of an individual co-operative in a particular sector is that co-operative's sales as a percentage of the total sales in that sector. The a priori expectation of market share in this study is positive. Table 6 reports the total market share of the various sectors of marketing co-operatives in the industry. Tables 67 - 72 in the Appendix to Chapter Three show the market share of individual co-operatives in the various sectors. The market shares of the individual co-operatives were calculated by finding the percentage of sales of an individual co-operative of the total sales in the industry in which the co-operative operates. The data showing the total sales of the various industries is presented in Table 78 in the Appendix to Chapter Three.

Table 6: Market Share of the Various Marketing Co-operatives in the Industry (1984 – 2001).

Years	Dairy (%)	P & E (%)	F & V (%)	H & M (%)	G & O (%)	Livestock (%)
1984	57	31	18	23	74	16
1985	58	34	21	23	74	16
1986	57	34	22	20	70	15
1987	58	35	19	23	72	18
1988	57	32	16	26	73	20
1989	56	35	17	26	75	19
1990	46	36	15	29	75	20
1991	59	39	14	23	74	23
1992	60	48	15	23	71	21
1993	63	47	18	29	55	21
1994	61	47	16	23	52	22
1995	57	47	15	31	55	18
1996	59	54	25	15	54	20

1997	62	47	15	22	54	18
1998	64	47	17	20	51	20
1999	66	48	12	21	49	19
2000	59	49	6	27	47	11
2001	42	49	8	28	45	14
Std. Dev	**5.76**	**7.40**	**4.53**	**3.94**	**11.54**	**3.03**
Mean	**57.83**	**42.17**	**16.06**	**24.00**	**62.22**	**18.39**
Min.	**42.00**	**31.00**	**6.00**	**15.00**	**45.00**	**11.00**
Max	**66.00**	**54.00**	**25.00**	**31.00**	**75.00**	**23.00**
Var	**33.21**	**54.74**	**20.53**	**15.53**	**133.24**	**9.19**

Source: Annual Publications of Co-operatives Secretariat (1984 – 2001)

From Tables 60-65 in the Appendix to Chapter Three, it is seen that the individual market shares of the co-operatives are very small. The standard deviations of the individual co-operatives are also very small: implying that the low values are consistent. This may mean that there are many firms and co-operatives in the industries and market concentration is low.

(d) Market Concentration

Market concentration may be used to determine the market power of a firm or sector. In measuring the performance of a co-operative, concentration of the industry in which the co-operative operates may affect the co-operative's performance in the market. Concentration in a sector or industry can be measured with the Herfindahl index. The Herfindahl index is a measure of industry concentration equal to the sum of the squared market shares of all the firms in the industry (i.e. both co-operatives and investor-owned firms). Herfindahl indices are measured between the values of zero and one with numbers approaching zero meaning less to no concentration and one meaning very high to maximum concentration. Decreases in the Herfindahl index could indicate a loss of pricing power and an increase in competition, whereas increases could imply the

opposite. The trend in the Herfindahl Index for the various sectors is presented in Table 7.

Table 7: Herfindahl Indices in the Various Industries (1984 – 2001)

Year	Dairy	P & E	F & V	H & M	G & O	Livestock
1984	0.07	0.05	0.06	0.06	0.18	0.04
1985	0.08	0.05	0.06	0.06	0.18	0.05
1986	0.08	0.05	0.06	0.06	0.18	0.05
1987	0.07	0.05	0.06	0.06	0.19	0.05
1988	0.07	0.05	0.06	0.06	0.17	0.04
1989	0.07	0.06	0.06	0.06	0.17	0.04
1990	0.09	0.07	0.06	0.06	0.17	0.04
1991	0.08	0.07	0.07	0.06	0.17	0.03
1992	0.09	0.07	0.06	0.07	0.19	0.03
1993	0.09	0.07	0.06	0.07	0.18	0.04
1994	0.09	0.07	0.06	0.07	0.18	0.04
1995	0.10	0.07	0.06	0.07	0.18	0.04
1996	0.10	0.06	0.06	0.08	0.18	0.04
1997	0.10	0.06	0.07	0.08	0.18	0.04
1998	0.06	0.06	0.05	0.07	0.14	0.03
1999	0.08	0.06	0.05	0.07	0.12	0.04
2000	0.08	0.05	0.05	0.07	0.11	0.05
2001	0.13	0.05	0.05	0.07	0.09	0.05
Std. Dev	**0.02**	**0.01**	**0.01**	**0.01**	**0.03**	**0.01**
Mean	**0.09**	**0.06**	**0.06**	**0.07**	**0.16**	**0.04**
Min.	**0.06**	**0.05**	**0.05**	**0.06**	**0.09**	**0.03**
Max	**0.13**	**0.07**	**0.07**	**0.08**	**0.19**	**0.05**
Var	**0.0003**	**0.0001**	**0.00003**	**0.00005**	**0.0008**	**0.00005**

Source : Annual Survey of Manufactures, Statistics Canada. Catalogue No. 31-203-XPB

Looking at the Herfindahl indices for the various industries presented in Table 7, it is seen that across the industries, the Herfindahl indices are approaching zero. This may mean that there is very little concentration in these industries. There exists competition amongst the firms and co-operatives present in each industry. Since co-operatives are operating in these less concentrated industries, it can be assumed that co-operatives and investor-owned firms are operating with similar objective functions. From Table 7, it is seen that the grain and oilseed sector is becoming more competitive particularly after

1995 when the Canadian Grain Commission stopped regulating elevation charges. The dairy sector on the other hand is becoming more concentrated.

(e) Membership size

Gorton and Schmid (1999), using Australian co-operative banking as their case study, showed that co-operative firm performance declines as the number of members increases. Gorton and Schmid suggest that horizon problems may arise in larger co-operative firms, leading to a decline in their performance. A negative relationship is thus expected between membership size and firm performance. Tables 66 to 71 in the Appendix to Chapter Three show the trend in membership size of the co-operatives used in this study.

From Tables 66 to 71 in the Appendix to Chapter Three reporting membership sizes for the individual co-operatives, it is found that membership size moved in both directions across the sectors. For the dairy co-operatives, all the co-operatives except two (which had increasing membership size) had decreasing membership size over the study period. One poultry and egg co-operative had increasing membership while the other had decreasing membership size. All the fruit and vegetable and honey and maple co-operatives had decreasing membership. One grain and oilseed co-operative had decreasing membership size and the other two had increasing membership. Both livestock co-operatives had increasing membership size. The study by Katz (1985) concluded that membership size has a negative effect on productivity. Given the trend discussed above and the conclusion by Katz, membership size is expected to have a negative effect on financial ratio.

(f) Financial Leverage

According to Fama and French (1995), there is a negative cross-sectional correlation between leverage and profitability. Profitability of a firm gives the ability of that firm to use retained earnings over external finance. Thus a negative association could be expected between a firm's profitability and its debt ratio. On the other hand, firms with higher liquidity ratios might support a relatively higher debt ratio, due to a greater ability to meet short-term obligations when they fall due (Panno, 2003). Therefore, a positive relationship could also be expected between a firm's liquidity position and its debt ratio. For co-operatives, previous studies have suggested that co-operatives have higher leverage than investor-owned firms (Parliament et al., 1990). Thus, for co-operatives, a negative relationship could be expected between liquidity and leverage. Tables 72 to 87 in the Appendix to Chapter Three show the debts incurred by the co-operatives across sectors.

The debts of the various co-operatives in the sectors are reported in Tables 72 to 77. It is observed that over the study period, the debts of almost all the co-operatives across all sectors have increased. A negative relationship is expected between debt and the financial performance ratios.

(g) Producer Welfare

The objectives of co-operatives do not only involve the buying of goods from producers but also the provision of certain services like processing, providing better marketing channels, etc. to the producers, which add value to their welfare. Members get patronage and value from sales to the co-operative as compared to investor-owned firms which only give producers value from sales. Therefore, when assessing the performance

of co-operatives, it will be worthwhile to capture this producer welfare in the calculation. How is producer welfare measured? Some studies have used operating profit as a measure of producer surplus.

3.2.4 Summary of Financial Ratio Analysis

For the estimation of the financial ratio analysis discussed above, the regressions are carried out for individual co-operatives in the regulated and non-regulated sectors. The data suggest that there are sequential differences across sectors in the various underlying factors. The results of the financial ratios are discussed at the individual co-operative level and then at the sector level. The results at the sector level are then compared with results from the other co-operative sectors. The regression results obtained can be used to compare co-operatives and sectors.

3.3 Estimation of Co-operatives' Economic Efficiency

Economic efficiency of a firm can be conceptualized as comprising two main components (Farrell, 1957): first, technical efficiency which involves the firm's ability to obtain the maximum possible output from a given set of resources; second, allocative efficiency which concerns its ability to maximize profits, by equating the marginal revenue product with the marginal cost of inputs (Kalirajan, 1990).

One of the fundamental decisions in measuring efficiency is the choice of concept to use. The two most important economic efficiency concepts that are based on production economic decision making are cost and profit efficiencies. Economic efficiency based on a profit function measures how close a co-operative is to producing the maximum possible profit given a particular level of input prices and output prices.

Economic efficiency based on a cost function provides a measure of how close a co-operative's cost is to what a best-practice co-operative's cost would be for producing the same output bundle under the same conditions.

The two approaches differ in terms of the fundamental objective function. The objective of the profit function approach is to maximize profits subject to a production function with input and output prices given. The objective of the cost function approach is to minimize costs subject to a production function with input and output prices given. The profit function dependent variable is specified in terms of variable profits instead of variable costs and takes input and output prices as given, as opposed to keeping output quantities fixed in the case of the cost function. The profit function approach is also known to have some advantages over the cost function. The primary advantage of the profit function is that it allows for measurement of inefficiencies on the output side, as well as on the input side of the firm (Berger et al., 1993); (Berger and Mester, 1997). Standard cost function approaches neglect output inefficiencies (Berger and Mester, 1997). The empirical results of profit efficiency measures depend on the approach that is used and on the assumptions imposed under a particular approach. In this study, the profit efficiency frontier will be used in the estimation because no previous empirical work has been done in the co-operative sector using the profit efficiency approach to assess performance and since the available data enable this.

Common frontier efficiency estimation techniques are data envelopment analysis (DEA), free disposable hull analysis (FDH), the stochastic frontier approach, the thick frontier approach, and the distribution-free approach. DEA and FDH are non parametric methods, the rest are parametric. The non-parametric methods generally ignore prices and

can, therefore, account only for technical inefficiency in using too many inputs or producing too few outputs (Sengupta, 1995; Murillo-Zamorano and Vega-Cervera, 2000). Another drawback is that the non-parametric methods usually do not allow for random error in the data, and assume away measurement error and luck as factors affecting outcomes. In effect, the non-parametric methods disentangle efficiency differences from random error by assuming that random error is zero (Mester, 2003).

Several studies use measures based on profit maximization efficiency as an indicator of performance. An early application of the profit function to the analysis of economic efficiency was made by Lau and Yotopoulos (1978). Since that time, the profit function has been the most widely used approach in analyzing economic efficiency (Holloway, 1986; Maudos and Pastor, 2003). Vennet (2000) carried out a study to analyze the profit and cost efficiencies of European financial conglomerates and universal banks. The author wanted to find out which type of bank performs better. For measurement, a translog form of the profit function, an application of the measure outlined by Berger and Mester (1997) which relates profit to input prices and output quantities, was used instead of output prices. This concept may be helpful when some of the assumptions underlying cost and profit based efficiency measures are not met. The alternative profit function employs the same dependent variable as the profit function and the same exogenous variables as the cost function. Thus, instead of counting deviations from optimal output as inefficiency, as in the profit function, the output variable is held constant as in the cost function while output prices are free to vary and affect profits (Berger and Mester, 1997). Vennet's results showed efficiency to be higher in universal banks than in non-universal banks. Westley and Shaffer (1998) also estimated a translog

profit function from a micro dataset of credit unions in Latin American countries to explore the empirical linkages between credit union policies and their financial performance. They concluded that performance depended on credit union policies associated with the incentives of borrowers to repay and the credit union's ability to screen loans. Casu and Girardone (2004), carried out a study to assess the performance of financial conglomerates in Italy. Their aim was evaluate the cost characteristics, profit efficiency and productivity of Italian financial conglomerates during the 1990s. Casu and Girardone estimated alternative profit efficiency measures using the Fourier-flexible form of stochastic frontier analysis and concluded that efficient banking groups display a high return profile.

Akhavein et al (1997), examined the efficiency of mergers in the US banking sector and these effects on performance, using a frontier profit function specifying a normalized quadratic variable profit function form. The authors found that merged banks experienced a significant increase in the profit efficiency measure relative to other banks. Fan and Shaffer (2004) also used this measure to estimate performance. Their paper studied the profit efficiency of a sample of large U.S. commercial banks and explored how this performance varies with selected measures of bank risk reflecting aspects of credit risk, liquidity risk, and insolvency risk. Fan and Shaffer use a standard profit function and the stochastic frontier approach, and compared two standard functional forms - Cobb-Douglas and translog - to assess the tradeoff between precision and parsimony. They found profit efficiency to be sensitive to credit risk and insolvency risk but not to liquidity risk or to the mix of loan products (Fan and Shaffer, 2004). Maudos and Pastor (2003) used the data envelopment analysis technique approach of profit

efficiency measure to analyze the efficiency in profits of the Spanish banking sector. Their results showed the existence of very low profit efficiency levels in this sector.

From this literature review on efficiency studies it is seen that a majority of the studies carried out recently are on the banking industry. This study will look at profit efficiency in the agricultural marketing sector.

3.3.1 Theoretical Foundations of the Profit Function

Consider a co-operative producing a single output Y_i from a set of factors comprised of variable inputs. The production function of the co-operative is given by;

$$Y_i = F(X_1,.....,X_n) \quad \text{.....(3.1)}$$

where the X_is are the variable inputs.

In a competitive environment, both investor-owned firms and co-operatives attempt to maximize profits by equating the marginal value product of the variable inputs to their respective input prices. Assuming output price is P_i and input price is w_i, then profits are maximized when X_i is used such that the following holds:

$$P_i * \frac{\partial F(X_1,....., X_n)}{\partial X_i} = w_i \quad \text{.....(3.2)}$$

According to Diewert (1974), under the above assumptions, the behaviour of the investor-owned firm can be characterized by its profits, π, which are expressed in terms of the output price, the variable input prices and the level of fixed inputs used;

i.e. $\pi(P_i, w_i) = Max \{P_i * F(X_1,....X_n) - w_i * X_i\}$

S.t. $Y_i = F(X_1,.....,X_n)$ .....(3.3)

A co-operative's objective is members' welfare maximization which requires it to maximize profit and producer surplus. This welfare can be also be expressed in terms of the output price, and the variable input prices as follows:

$$\pi(P_i, w_i) + PS(w_i) = Max\ \{P_i * F(X_1,\ldots,X_n) - w_i * X_i\} + \{w_i * X_i - \int_0^{X_i} P(X_i)\partial X_i\}$$

$$S.t.\ Y_i = F(X_1,\ldots\ldots,X_n) \quad \ldots\ldots(3.4)$$

In order to ensure that there is a one to one correspondence with a well defined production possibility set, it is sufficient that the profit function satisfies certain properties. According to Diewert (1974), these properties are:

1. No losses (i.e. profits must be greater than zero): $\pi(P_i, w) \geq 0$

   A firm will not tolerate negative profits. If it is making negative profits, it can always stop all production and be better off. However, this is not always the case; a firm may be willing to make temporary losses, at least for a while. But, as that is usually temporary, one might as well simply restrict profits to be non-negative.

2. Non-decreasing in P_i: If $P_i' \geq P_i$, then $\pi(P_i', w) \geq \pi(P_i, w)$

   If output price increases and input prices remain unchanged, then the maximum profits increase.

3. Non-increasing in w: If $w' \geq P_i$, then $\pi(P_i, w') \leq \pi(P_i, w)$

   If an input price increases and all other prices are the same, then profits will fall.

4. Convexity in P_i and w

5. Continuity in P_i and w

   Properties 4 & 5 suggest that when prices change, the behaviour of the firm changes by adjusting its inputs and outputs accordingly.

6. Homogeneous of degree one in P_i and w: $\pi(\lambda P_i, \lambda w) = \lambda\pi(P_i, w)$

7. Hotelling's Lemma: $\partial\pi(P_i, w)/\partial P_i = y, \partial\pi(P_i, w)/\partial w_i = -x_i$

If profit functions are differentiable at P_i and w_i, then Hotelling's lemma implies that differentiating the profit function with respect to output price yields output quantity, while differentiating it with respect to the price of a particular input yields (the negative of) the corresponding input quantity (Diewert, 1974).

Based on the properties of the profit function given above, if these conditions are met, the output supply and input demand functions can be derived as the partial derivatives of the profit function with respect to the price of the output and the prices of the variable inputs respectively.

$$\frac{\partial\pi(P_i, w_i)}{\partial P_i} = S_i(P_i, w_i) \quad \text{.....(3.5)}$$

$$\frac{\partial\pi(P_i, w_i)}{\partial w_i} = -D_i(P_i, w_i) \quad \text{.....(3.6)}$$

Lau (1978) shows that duality does not require the profit function to be homogeneous of degree one in the fixed inputs. However, homogeneity in prices is a necessary condition for duality. In the case of a single output, it is convenient to impose this by normalizing profits and the prices of the variable inputs on output price.

After normalization, equation 3.3 now becomes

$$\pi^*(w_i^*) = \underset{X_i}{Max} \{ F(X_1,\ldots,X_n) - (w_i^*)^* X_i \} \quad \text{.....(3.7)}$$

Where $\pi^* = \pi / P_i$ *and* $w_i^* = w_i / P_i$.

Therefore the variable input demand equation from the normalized profit function is given as

$$\frac{\partial \pi^*(w_i^*)}{\partial w_i^*} = -D_i(w_i^*) \quad \text{.....(3.8)}$$

The output supply function can be derived as:

$$S_i(w_i^*) = \pi^*(w_i^*) - w_i^* * \left[\frac{\partial \pi^*(w_i^*)}{\partial w_i^*}\right] \quad \text{.....(3.9)}$$

3.3.2 *Application of the Profit Function to Economic Efficiency*

Following Lau and Yotopolous (1972) and Lau (1978), let us consider two groups of firms (group i and j), producing the same output, Y_i from the same inputs (X_i and Z_i). Assume that their production functions differ only in terms of a neutral technical shift parameter (A).

The production functions of the two groups are given as:

$$Y_i = A^i * F(X_i) \quad \text{.....(3.10)}$$

$$Y_i = A^j * F(X_j) \quad \text{.....(3.11)}$$

Assuming the two groups of firms attempt to maximize profits, but are not necessarily successful in achieving this objective, each group would then equate the marginal products of the variable factors to some multiplicative value (say k) of the normalized input price. Under these assumptions, the marginal conditions are given as:

$$\frac{\partial F(X)}{\partial X_i} = \frac{(k_i^i * w_i^*)}{A^i} = \frac{(k_i^j * w_i^*)}{A^j} \quad \text{.....(3.12)}$$

The above equation implies that groups i and j act as if they maximize profits by taking as given $\frac{(k_i^i * w_i^*)}{A^i}$ and $\frac{(k_i^j * w_i^*)}{A^j}$ respectively Lau and Yotopolous (1972).

3.3.3 *Allocative Efficiency*

Following Lau and Yotopolous (1971), k_i^i and k_i^j may be considered as allocative efficiency parameters of groups i and j respectively. These parameters show how the groups make their decisions. Absolute allocative efficiency occurs when there is profit maximization and the value of $k = 1$. The two groups will be said to attain equal allocative efficiency if $k_i^i = k_i^j$.

The direction of the divergence in each of these allocative efficiency parameters from the optimal value of one can be used to determine whether or not the groups have been under-allocating or over-allocating resources to their variable inputs. The optimal value of k_i is one (Lau, 1978).

A firm is allocatively inefficient when the marginal rate of technical substitution between any two of its inputs is not equal to the ratio of corresponding input prices. Reasons for allocative inefficiency include regulatory constraints and sluggish adjustment to price changes (Atkinson and Cornwell, 1994).

3.3.4 Technical Efficiency

A firm is considered to be technically efficient if it produces maximum output from a given set of inputs. Due to the absence of any upper limit to production, technical efficiency measures are relative (Holloway, 1986). From equations 9 and 10, it is evident that differences in technical efficiency between groups i and j may be characterized by a difference in the magnitude of A^i, relative to A^j. For instance, if A^i is greater than, equal to, or less than A^j, group i firms are, respectively, superior to, equivalent to, or inferior to group j firms in terms of their relative level of technical efficiency.

3.3.5 Incorporating Technical and Allocative Efficiency into the Profit Function

Kumbhakar (1996) used a profit maximization framework and developed a generalized profit function approach that accommodates both technical and allocative inefficiencies in the context of a panel data model. He also derived a flexible production function from the relationship between production technical inefficiency (which he defined as loss of output due to technical inefficiency) and profit technical inefficiency (which he defined as profit due to technical inefficiency). Kumbhakar showed that in a profit maximizing framework with panel data, it is possible to distinguish between technical change and time-varying technical efficiency. He went on further to say that such a distinction is however not possible if one uses either a production or cost function in estimation (Kumbhakar, 1996).

We follow Lau and Yotopolous (1971) in considering a group of *i* firms. Their technical and allocative efficiency parameters may be incorporated into their objective function as follows:

$$\pi_i^* = \underset{X_i}{Max} \{ A^i * F(X_1,\ldots,X_n) - \sum_i^n (k_i^i * w_i^*) X_i \}$$

$$\pi_i^* = A^i * \underset{X_i}{Max} \{ F(X_1,\ldots,X_n) - \sum_i^n (k_i^i * w_i^*) X_i \}$$

$$\pi_i^* = A^i * \pi^*\left(\frac{(k_i^i * w_i^*)}{A^i}\right) \qquad (3.13)$$

where

π_i^* = behavioural normalized profit function for group i. This specifies the maximum level of profits attainable given k^i and A^i.

Therefore, by applying the Sheppard-Uzawa-McFadden Lemma (Lau, 1969), the actual input demand and output supply functions can be derived from π_i^*.

The input demand function is given as:

$$D_i^* = -\frac{\partial \pi^*(k_i^i * w_i^* / A^i)}{\partial (k_i^i * w_i^* / A^i)} \quad \text{.....(3.14)}$$

The output supply function is also given as:

$$S_i^* = \pi_i^* - \sum_i^n (k_i^i * w_i^*) * \left\{ \frac{\partial \pi^*(k_i^i * w_i^* / A^i)}{\partial (k_i^i * w_i^* / A^i)} \right\} \quad \text{.....(3.15)}$$

The values of D_i^* and S_i^* in equations 3.14 and 3.15 are the actual quantities of inputs demanded and output supplied given k^i and A^i. By definition, actual normalized profits are, the difference between actual output supplied minus the normalized cost of the variable inputs (Holloway, 1986).

Therefore the actual profits for group i, π_a^*, may be obtained as follows:

$$\pi_a^* = S_i^* - \sum_i^n w_i^* * \left\{ \frac{\partial \pi^*(k_i^i * w_i^* / A^i)}{\partial (k_i^i * w_i^* / A^i)} \right\}$$

$$\pi_a^* = \pi_i^* - \sum_i^n (1 - k_i^i) * w_i^* * \left\{ \frac{\partial \pi^*(k_i^i * w_i^* / A^i)}{\partial (k_i^i * w_i^* / A^i)} \right\}$$

$$\pi_a^* = A^i * \pi^*(k_i^i * w_i^* / A^i) - \sum_i^n (1 - k_i^i) * w_i^* * \left\{ \frac{\partial \pi^*(k_i^i * w_i^* / A^i)}{\partial (k_i^i * w_i^* / A^i)} \right\} \quad \text{.....(3.16)}$$

Note that, if $k_i^i = 1$ holds for all the variable inputs, then actual and behavioural profits are the same (Lau and Yotopolous, 1971).

3.3.6 Objective of Co-operatives

As noted in Chapter Two, there is a difference between the objective functions for co-operatives and investor-owned firms. The investor-owned firm seeks to maximize their profits. The co-operative, on the other hand seeks to maximize their members' welfare. To do that, the co-operative will have to maximize profit plus producer surplus. Thus, in estimating the profit efficiencies of investor-owned firms and co-operatives, this difference should be considered. In competitive markets, co-operatives are reduced to maximize profits just like the investor-owned firms.

From the Herfindahl indices discussed from Table 7, it is seen that there is not a high level of concentration in the various industries. This suggests there is competition in the industries in which the co-operatives operate. In a perfectly competitive environment, co-operatives and investor-owned firms are price takers and therefore the co-operative would maximize profit as the investor-owned firm would do. The profit function for the co-operative will therefore be the same as that of the investor-owned firm under this environment. Following Lau and Yotopoulos (1972), the profit function for the co-operative in a perfectly competitive environment is given as:

$$\pi_c^* = A^i * \pi^*(k_i^i * w_i^* / A^i) - \sum_i^n (1 - k_i^i) * w_i^* * \left\{ \frac{\partial \pi^*(k_i^i * w_i^* / A^i)}{\partial (k_i^i * w_i^* / A^i)} \right\}$$

where

π_c^* = profit function of the co-operative

3.3.7 Choice of Functional Forms

Most previous studies of efficiency that focus on profit function have employed different functional forms in estimation; of these, the Cobb-Douglas functional form is

the most used. The use of the Cobb-Douglas functional form has one disadvantage: the cross-price elasticity estimates are restricted to be constant across each of the endogenous variables in the model (Holloway, 1986). To be able to overcome this shortcoming of the Cobb-Douglas functional form, a more flexible functional form is required. Some examples of flexible functional forms are the Generalized Leontief, the Normal Quadratic, the Translog and the Translog – Fourier functions.

In specifying the estimation model, the translog functional form of the profit function is used in this study because of the flexibility it allows in estimating parameters where it is not desirable to build in through model specification rigid assumptions about substitution relationships among inputs and factors. The use of the translog profit frontier has become increasingly popular since it is less restrictive than other functional forms such as the Cobb-Douglas and constant elasticity of substitution (CES) forms (Villezca-Becerra and Shumway, 1992; Estrada and Osorio, 2004). According to Diewert (1974), the translog functional form can represent the true data generating function.

3.3.8 The Translog Model

Following Holloway (1986), the general form of the normalized profit model under the translog specification is as follows:

$$In\pi^{*} = \beta_0 + \sum_{i}^{n} \beta_i * Inw_i^{*} + \frac{1}{2} * \sum_{i}^{n} \sum_{j}^{n} \beta_{ii} * Inw_i^{*} * Inw_i^{*} + \frac{1}{2} * \sum_{i}^{n} \sum_{j}^{n} \beta_{ij} * Inw_i^{*} * Inw_j^{*} \tag{3.17}$$

Substituting equation 3.17 into equation 3.16, we obtain the expressions for actual normalized profits and actual shares of the variable inputs. Letting the superscript j

denote each of the m groups to be compared, the system of equations to be estimated for a co-operative in a perfectly competitive market is given as:

$$In(\pi_a^{*j}) = In(A^j) + \beta_0 + \sum_i^n \beta_i * In(k_i^j * w_i^* / A^j)$$
$$+\frac{1}{2} * \sum_i^n \sum_i^n \beta_{ij} * In(k_i^j * w_i^* / A^j) * In(k_j^j * w_j^* / A^j)$$
$$-In\left\{1 + \sum_j^n ((1-k_i^j)/k_i^j) * \left[\beta_i + \sum_j^n \beta_{ij} * In(k_j^j * w_j^* / A^j)\right]\right\} \quad (3.18)$$

$$(D_i^* * w_i^*)/\pi_a^{*j} = -\left\{\beta_i + \sum_j^n \beta_{ij} * In(k_j^j * w_j^* / A^j)\right\}$$
$$* \left\{1 + \sum_i^n ((1-k_i^j)/k_i^j) * \left[a_i + \sum_j^n \beta_{ij} * In(k_j^j * w_j^* / A^j)\right]\right\}^{-1} * (k_i^j)^{-1} \quad (3.19)$$

where

$i = 1, 2.....n$

$j = 1, 2.....m$

The above equations are specified based on the objective function of an investor-owned firm. The objective of the investor-owned firm is to maximize profits. This equation will also hold for a co-operative operating in a perfectly competitive market.

Therefore, for the co-operative, the profit model discussed above is given as;

$$In(\pi_a^{*j}) = In(A^j) + \beta_0 + \sum_i^n \beta_i * In(k_i^j * w_i^* / A^j)$$
$$+\frac{1}{2} * \sum_i^n \sum_i^n \beta_{ij} * In(k_i^j * w_i^* / A^j) * In(k_j^j * w_j^* / A^j)$$
$$-In\left\{1 + \sum_j^n ((1-k_i^j)/k_i^j) * \left[\beta_i + \sum_j^n \beta_{ij} * In(k_j^j * w_j^* / A^j)\right]\right\}$$

(3.20)

where

(π_a^{*j}) = profits of the co-operative.

From the data, the profits of the co-operative are calculated by deducting the co-operative's expenses from its sales. The variable inputs are labour, raw materials and capital. The price of output is the product price of the various products of the co-operative. For estimation, the above equation is expanded as follows:

$$In\pi = In(A) + \beta_0 + \beta_1[Ink_1 + InPL - InA] + \beta_2[Ink_2 + InPC - InA] + \beta_3[Ink_3 + InPR - InA]$$
$$+\frac{1}{2}[\beta_{11}(Ink_1 + InPL - InA) * (Ink_1 + InPL - InA)] + \frac{1}{2}[\beta_{12}(Ink_1 + InPL - InA) * (Ink_2 + InPC - InA)]$$
$$+\frac{1}{2}[\beta_{13}(Ink_1 + InPL - InA) * (Ink_3 + InPR - InA)] + \frac{1}{2}[\beta_{21}(Ink_2 + InPC - InA) * (Ink_1 + InPL - InA)]$$
$$+\frac{1}{2}[\beta_{22}(Ink_2 + InPC - InA) * (Ink_2 + InPC - InA)] + \frac{1}{2}[\beta_{23}(Ink_2 + InPC - InA) * (Ink_3 + InPR - InA)]$$
$$+\frac{1}{2}[\beta_{31}(Ink_3 + InPR - InA) * (Ink_1 + InPL - InA)] + \frac{1}{2}[\beta_{32}(Ink_3 + InPR - InA) * (Ink_2 + InPC - InA)]$$
$$+\frac{1}{2}[\beta_{33}(Ink_3 + InPR - InA) * (Ink_3 + InPR - InA)]$$
$$-In\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right] * \left[\begin{array}{l}\beta_{11}(Ink_1 + InPL - InA) + \beta_{22}(Ink_2 + InPC - InA) \\ +\beta_{33}(Ink_3 + InPR - InA)\end{array}\right]$$

(3.21)

where

π = normalized profit (ie profit divided by price of output)

PL = normalized price of labour

PR = normalized price of raw material

PC = normalized price of capital

3.3.9 Farm Level Supply Equation

A farm level supply equation can be specified to establish producer surplus for the industry and the amount of produce that producers supply to the co-operatives. The output of these producers then becomes the input for the co-operatives. To be able to specify a farm supply equation, we must first of all look at the underlying economic theory. At the farm level, producers produce some amount of produce to the market based on output price and some factors including input prices. Duff and Goddard (1997) specified a farm level supply function in their study to measure market power in the Canadian dairy industry. In their study, they defined farm fluid milk supply as a function of farm marginal cost, time trend and the lagged dependent variable. Holloway (1991) also specified an inverse supply relation for farm commodities to verify the hypothesis that the food industries in the US are perfectly competitive. He specified an inverse supply function with price of the commodities being the dependent variable and quantity and other exogenous variables that affect the production of the commodities as independent variables.

In this study, we first consider the effect of supply management on the supply of produce by dairy and poultry and eggs producers. Supply management results in a change in farm price. With supply management, the administered cost of production-based farm price and supply are not directly related to the supply curve but are assumed to be related

to processor demand (Duff and Goddard, 1997). At the farm level, processors pay the farm price. In supply-managed sectors, the farm price processors pay is assumed to represent the marginal cost price and the static per unit quota value. The non-supply managed sectors (i.e. fruits and vegetables, honey and maple, grains and livestock) do not have quota value, so the farm price paid by processors in these sectors is assumed to be the marginal cost price.

From the above discussion and following Duff and Goddard (1997), the farm level price-dependent supply equation of producers to be estimated in this study can be specified as follows;

$$P = f(TT, P_{out}(-1), PL, PF, TQ, \beta)$$

where

P = price of produce

TT = Time Trend

$P(-1)$ = lagged dependent variable

PL = price of labour

PF = price of feed grains (for dairy, poultry and eggs, and livestock producers), price of fertilizer (for fruits and vegetables, grains and oilseeds producers)

But P = Farm price paid by processors

Note: Farm price for producers in supply-managed sectors = MCP + Quota value.

Farm price for producers in non supply-managed sectors = MCP

MCP = Marginal Cost Price for producer

TQ = total quantity of output supplied to processors

But X_i = quantity of output supplied to co-operatives

$\therefore TQ = X_i$ / Market share of co-operatives

β = coefficients or parameters to be estimated

Therefore the supply equation can be given as:

$$P = \beta_0 + \beta_1 * TT + \beta_2 * P_{out}(-1) + \beta_3 * PL + \beta_4 * PF + \beta_5 * TQ \quad \text{.....(3.23)}$$

where

MS = Market share of co-operatives

To be able to estimate the above price dependent supply equation, the quantity of produce supplied to co-operatives will have to be determined. The total quantity of produce supplied by farmers was obtained from the CANSIM database. Using the market share of co-operatives as a proxy for their share of the total quantity of produce received, the quantities of produce supplied to the various sectors of the marketing co-operatives were calculated. To estimate quantity received by each individual co-operative the quantity of produce supplied to the sector in which the co-operative is located is multiplied by the market share of that individual co-operative. The share of the individual co-operative is calculated on the assumption that the co-operatives reporting to the survey are a fair representation of all the co-operatives in that sector. With that assumption, the ratio of the sales of an individual co-operative to the total sales in the sector is that individual co-operative's market share.

3.3.10 Estimation of Profit Maximization Function For Co-operatives

From the profit function model derived in the previous sections, the system of equations that is used for the profit function and efficiency estimation are as follows;

The profit equation

$$
\begin{aligned}
In\pi &= InA + \beta_0 + \beta_1 Ink_1 - \beta_1 InA + \beta_1 InPL \\
&+ \beta_2 Ink_2 - \beta_2 InA + \beta_2 InPC \\
&+ \beta_3 Ink_3 - \beta_3 InA + \beta_3 InPR \\
&+ \frac{1}{2}\left[\beta_{11}(Ink_1^2 + 2Ink_1 * InPL - 2Ink_1 * InA + InPL^2 - 2InA * InPL + InA^2)\right] \\
&+ \begin{bmatrix} \beta_{12}(Ink_1 * Ink_2 + Ink_1 * InPC - Ink_1 * InA + InPL * Ink_2 + InPL * InPC - InPL * InA \\ - InA * Ink_2 - InA * InPC + InA^2) \end{bmatrix} \\
&+ \begin{bmatrix} \beta_{13}(Ink_1 * Ink_3 + Ink_1 * InPR - Ink_1 * InA + InPL * Ink_3 + InPL * InPR - InPL * InA \\ - InA * Ink_3 - InA * InPR + InA^2) \end{bmatrix} \\
&+ \frac{1}{2}\left[\beta_{22}(Ink_2^2 + 2Ink_2 * InPC - 2Ink_2 * InA + InPC^2 - 2InA * InPC + InA^2)\right] \\
&+ \begin{bmatrix} \beta_{23}(Ink_2 * Ink_3 + Ink_2 * InPR - Ink_2 * InA + InPC * Ink_3 + InPC * InPR - InPC * InA \\ - InA * Ink_3 - InA * InPR + InA^2) \end{bmatrix} \\
&+ \frac{1}{2}\left[\beta_{33}(Ink_3^2 + 2Ink_3 * InPR - 2Ink_3 * InA + InPR^2 - 2InA * InPR + InA^2)\right] \\
&- In\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right] * \begin{bmatrix} \beta_{11}(Ink_1 + InPL - InA) + \beta_{22}(Ink_2 + InPC - InA) \\ + \beta_{33}(Ink_3 + InPR - InA) \end{bmatrix}
\end{aligned}
$$

(3.24)

Following Lau and Yotopolous (1972), the input demand equations are derived from the profit equation above as follows;

Share Equation for Labour

$$
\begin{aligned}
\frac{\partial In\pi}{\partial InPL} &= \beta_1 + \beta_{11}(Ink_1 - InA + InPL) + \beta_{12}(Ink_2 - InA + InPC) + \beta_{13}(Ink_3 - InA + InPR) \\
&- \beta_{11} * In\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]
\end{aligned}
$$

(3.25)

Share Equation for Capital

$$\frac{\partial In\pi}{\partial InPC} = \beta_2 + \beta_{22}(Ink_2 - InA + InPC) + \beta_{12}(Ink_1 - InA + InPL) + \beta_{23}(Ink_3 - InA + InPR)$$
$$- \beta_{22} * In\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right] \qquad (3.26)$$

Share Equation for Raw Material

$$\frac{\partial In\pi}{\partial InPR} = \beta_3 + \beta_{33}(Ink_3 - InA + InPR) + \beta_{13}(Ink_1 - InA + InPL) + \beta_{23}(Ink_2 - InA + InPC)$$
$$- \beta_{33} * In\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right] \qquad (3.27)$$

The endogenous variables are the actual normalized profits, π_a*, and the demand for the variable inputs; the exogenous variables are the normalized prices of the variable inputs (i.e. *PL, PC, PR*) and the quantity of variable inputs (X_i). The parameters to be estimated consist of those derived from the original translog system (β_0, β_i, β_{ij},). Other parameters to be estimated are the respective group specific efficiency parameters (A and k_i^i).

Translog profit frontiers make use of logarithms in the dependent variables and thus do not handle cases of negative or zero unit profits. Yet it is not unreasonable to suppose that some co-operatives in some years lose money. To be able to deal with this problem, a constant scalar is added to the unit profit data in each sample such that unit profit of every co-operative is positive. As long as the cases of negative average co-operative profits are few (say, less than 5 percent), they are proportionately not very negative relative to average co-operative unit profit (so that the scalar is small relative to the mean), the resulting bias from a non-linear transformation of the data is judged to be

of minor importance compared to the bias that would arise from using a less appropriate functional form or arbitrarily dropping the least efficient sample members (Battese and Coelli, 1988).

3.4 Summary of the Chapter

The concept of financial ratio analysis and the factors that affect the financial performance of co-operatives were reviewed in this chapter. A conceptual model to analyze the financial performance of co-operatives was developed and the a priori expectations of the various factors were discussed. Based on the conceptual model developed, a multiple regression analysis was chosen to estimate financial performance.

In the second part of this chapter, there was a review of some methods of efficiency measures. The theoretical foundations of the profit function were discussed. The incorporation of allocative and technical efficiency measures was also discussed in this part of the chapter. The choice of a functional form for estimation was discussed. The functional form that was chosen for the profit function estimation in this study is the translog function. The profit function is conceptually derived for the co-operative. The input share equations were also derived from the profit function. The farm supply equation is also specified. This system of equations will be estimated jointly to assess the allocative and technical efficiencies of the co-operatives.

Having described the models to be used in detail in this chapter, the next chapter will explain the data and how the estimation models developed in this chapter were carried out. The results obtained from the estimations will also be discussed.

4.0 CHAPTER 4: FINANCIAL RATIO ANALYSIS RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, the description of the variables used in the estimation of the financial ratio analysis outlined in Figure 6 in Chapter Three and how they were obtained is discussed. In section 4.2, there is a description and analysis of the raw data used for the estimation of both the financial ratio analysis and the profit function. This includes examining the trends in the sales, assets, liabilities and equities of the marketing co-operatives. For the financial ratio analysis, the graphs of the financial ratios are plotted and examined, as the basis of some observations and interpretations. The results from the financial ratio analysis estimation are presented and discussed in this chapter.

4.2 Description and Analysis of the Data Set

Financial data from 1984 to 2001 were obtained from the Annual Survey of Agribusiness Co-operatives conducted by the Canadian Co-operatives Secretariat (CCS), Government of Canada. The financial data are an unbalanced panel data set consisting of 6085 observations of an average of about 312 supply and marketing co-operatives. The financial data contains information such as the cost of production, wages and salaries, number of full-time employees, volume of sales, costs of goods sold, long-term debt, number of members, assets, liabilities and others.

Data for the GDP deflator, Herfindahl Indices, interest rate, raw material price indices and farm input price indices were gathered from Statistics Canada's CANSIM database for the period 1984 to 2001. Farm level prices and wholesale prices of milk were obtained from the Canadian Dairy Information Centre. Prices for chicken and eggs,

fruits and vegetables, grains and livestock were obtained from Statistics Canada's CANSIM database, Table 329-0026. Honey prices were obtained from the Canadian Honey Council (CHC) website. The prices used in the study are reported in Tables 79 and 80 in the Appendix to Chapter Four. The study focused on marketing co-operatives, with emphasis on the supply-managed co-operatives, that is the dairy co-operatives and poultry and egg co-operatives). In the dataset, there are 36 dairy co-operatives (ten of these were used in the estimations), 9 poultry and egg co-operatives (two were used), 11 honey and maple co-operatives (two were used), 76 fruit and vegetable co-operatives (three were used), 28 grain and oilseed co-operatives (three were used) and 73 livestock co-operatives (two were used). The individual co-operatives used in the estimations are the co-operatives that have a number of observations more than sixteen; (that is, they provided data for more than sixteen years out of the eighteen-year span of the data set). The descriptive statistics for these cooperatives are presented in Table 80 in the Appendix to Chapter Four. Due to confidentiality reasons, the identity and origin of the co-operatives are not known and therefore they are identified by codes. The financial ratios used were calculated from the dataset.

For the financial ratio analysis, the financial ratios used were profit margin (to measure profitability) and current ratio (to measure liquidity). The independent variables used were membership size, firm size, price of input, time trend, the lagged dependent variable, the Herfindahl index to capture market concentration, individual market share of the co-operative and financial leverage. The numbers of members in a co-operative, obtained from the balance sheet for the individual co-operatives, were used as a measure of membership size. Total assets of the co-operative were used as a measure of firm size.

Farm output price was used as a proxy for producer welfare and financial leverage was calculated as debt-to-equity ratio or liability-to-equity ratio from the data. The double logarithmic form of the conceptual model specified in Figure 6 in the previous chapter was estimated; thus the coefficients of the independent variables are short run elasticities.

For the profit maximizing analysis carried out using equations 3.24 – 3.27 in Chapter Three (the profit and input demand functions equations), the variables used were profit, price of inputs, price of output and marginal costs. Prices of capital and labour were input prices for all the co-operatives. For the dairy co-operatives, the raw material input price is the farm price of unprocessed milk from Statistics Canada's database Table 329-0026. The output price is the quantity weighted average of the retail prices of butter, fluid milk and cheese. These prices were obtained from the Canadian Dairy Information Centre. For the poultry and eggs co-operatives, the raw material input prices used is the weighted average of the farm prices of chicken and eggs. The output price is the weighted average of the retail prices of chicken and eggs. For the honey and maple co-operatives, the raw material input price is the farm price of honey. The output price is the average retail price of honey. The farm and retail prices for honey were obtained from the Canadian Honey Council website. For the fruit and vegetable co-operatives, the raw material input prices used are the weighted averages of farm prices of fruits and vegetables consumed regularly in Canada. The output price is the weighted average of the retail prices of fruits and vegetables. The raw material input prices for the grains and oilseeds co-operatives are the weighted average of the farm prices of the most commonly used grains and oilseeds. The output price is the weighted average of the retail price of grains and oilseeds. The raw material input prices used for livestock co-operatives is the

farm price of beef. The output price is the average retail price of beef (the livestock co-operatives used in this study market beef).

To maximize the welfare of co-operative members, the welfare maximization objective of co-operatives is assumed to be to maximize profits plus producer surplus, as outlined in the previous chapter. To be able to achieve this, the conventional profit function should have a producer surplus component. Quantifying producer surplus and determining the functional form it should take proved to be a very difficult task. Therefore for the efficiency estimation, the assumption is made that the co-operative operates in a competitive environment and so maximizes profit like other investor-owned firms do. This assumption is substantiated by the Herfindahl indices in Table 7 in Chapter Three which suggest less concentration in the industries in which the co-operatives operate. Therefore the conventional profit function in equation 3.24 in Chapter Three was used in the estimation of efficiency.

4.3 Financial Ratios Results

The statistical model (the ordinary least squares regression model) as defined by Katz (1985), Fama and French (1993) and Slade (2003) is given as:

$$Ratio = \beta_0 + \beta_1 Size + \beta_2 M + \beta_3 FL + \beta_4 MS + \beta_5 PS + \beta_6 MC + \varepsilon \quad \text{.....(4.1)}$$

where;

Ratio = Financial Performance Ratio

Size = Firm size

M = Membership Size

FL = Financial Leverage

MS = Market Share

PS = Producer Surplus/Welfare

MC = Market concentration

ε = Error Term

Financial ratios (i.e., current ratio, debt-to-equity ratio, profit margin) were computed for the whole marketing co-operative sector and for the dairy, poultry and eggs, fruits and vegetables, honey and maple, grains and oilseeds, and livestock sub-sector groups. The financial ratios were calculated as follows from the data:

Current Ratio = Total Current Assets / Total Current Liabilities

Debt-to-Equity Ratio = Total Liabilities / Total Equity

Profit Margin = Profit + members' equity / Sales

Also, the financial ratios of individual co-operatives in each sub-sector group were computed and these are presented in Tables 82 to 93 in the Appendix to Chapter Four.

Using the financial ratios calculated, a Kruskal-Wallis test as described by Lerman and Parliament (1990) is carried out to examine whether the financial ratios calculated are statistically different for the co-operatives in the various sectors. The test is also used to examine whether the financial ratios of individual co-operatives in a particular sector are statistically different from each other. To carry out this test, certain assumptions are considered. These assumptions are:

1. the **k** samples are independently and randomly drawn from the source population (s)
2. the source population (s) may or may not have a normal distribution

The hypotheses to be tested for the Kruskal-Wallis test are as follows:

Testing across all sectors:

$\mathbf{H_0}$: The median financial ratios are identical for supply-managed and non supply-managed co-operatives.

$\mathbf{H_1}$: The median financial ratios are different for supply-managed and non supply-managed co-operatives.

Testing individual co-operatives within a particular sector:

$\mathbf{H_0}$: The median financial ratios are identical for individual co-operatives in the sector.

$\mathbf{H_1}$: The median financial ratios are different for individual co-operatives in the sector.

The H statistics of the Kruskal-Wallis test is given as follows:

$$H = \frac{SS_{bg(R)}}{N(N+1)/12} \quad \text{.....(4.1)}$$

where

N = Total number of observations for the **k** samples

$SS_{bg(R)}$ = between-groups sum of squared deviates

$$SS_{bg(R)} = \sum \left[n_i (M_i - M_{all})^2 \right] \quad \text{.....(4.2)}$$

n_i = the number of observation of the *ith* sample

M_i = the mean of the n_i ranks in sample i

M_{all} = the mean of the N ranks in all groups combined.

The hypothesis that the median financial ratios are identical is rejected if the calculated H statistic value exceeds the critical value taken from the X^2 distribution with **k-1** degrees of freedom.

Table 8 reports the Kruskal-Wallis tests carried out on the financial ratios (current ratio, debt-to-equity ratio, profit margin) of the co-operatives across all the sectors.

Table 8: Kruskal-Wallis Test For Financial Ratios Of Co-operatives Across All The Various Sub-Sectors

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	96.44	11.07	15.09	**Reject H_0**
Debt-To-Equity	60.20	11.07	15.09	**Reject H_0**
Profit Margin	60.87	11.07	15.09	**Reject H_0**

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

From the results in Table 8, it is seen that the null hypothesis is rejected at both 5% and 1% confidence levels for all the three financial ratios, indicating that the financial ratios differ across all the sub-sector groups. That is, the specific financial ratios for the various sub-sectors are different from each other. More tests were carried out by testing for the supply-managed and the non supply-managed sub-sectors separately and by pairing the supply-managed sub-sectors with the various sub-sectors. The results are reported in Tables 9 - 14.

Table 9: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy and Poultry and Egg Sub-Sectors (Supply-Managed Sub-Sectors)

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	3.91	3.84	6.64	Reject H_0 at 5%
Debt-To-Equity	6.23	3.84	6.64	Reject H_0 at 5%
Profit Margin	6.26	3.84	6.64	Reject H_0 at 5%

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 10: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Fruit And Vegetable, Honey And Maple, Grain And Oilseed And Livestock Sub-Sectors (Non Supply-Managed Sub-Sectors).

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	60.08	3.84	6.64	Reject H_0
Debt-To-Equity	58.41	3.84	6.64	Reject H_0
Profit Margin	64.90	3.84	6.64	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 11: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Honey and Maple Sub-Sectors

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	26.27	3.84	6.64	Reject H_0
Debt-To-Equity	25.78	3.84	6.64	Reject H_0
Profit Margin	20.90	3.84	6.64	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 12: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Fruits and Vegetable Sub-Sectors

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	24.56	3.84	6.64	Reject H_0
Debt-To-Equity	27.09	3.84	6.64	Reject H_0
Profit Margin	23.67	3.84	6.64	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 13: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Grain and Oilseed Sub-Sectors

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	22.24	3.84	6.64	Reject H_0
Debt-To-Equity	24.21	3.84	6.64	Reject H_0
Profit Margin	20.45	3.84	6.64	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 14: Kruskal-Wallis Test For Financial Ratios Of Co-operatives In The Dairy, Poultry And Egg And Livestock Sub-Sectors

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	30.76	3.84	6.64	Reject H_0
Debt-To-Equity	25.90	3.84	6.64	Reject H_0
Profit Margin	28.71	3.84	6.64	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

The results in Tables 9 to 14 show that the financial ratios of co-operatives in the dairy and poultry and egg sub-sectors differ at the 5% level of significance but not at the 1% level of significance, while the financial ratios of the non supply-managed sub-sectors differed at both 5% and 1%. This suggests that supply-managed co-operatives have similar financial ratios; the financial ratios of supply-managed and non supply-managed co-operatives differ.

The test was further carried within each sub-sector to examine whether the individual co-operatives in a sub-sector have identical financial ratios. Tables 15 to 20 show the Kruskal-Wallis tests on the financial ratios of the individual co-operatives within the various sub-sectors.

Table 15: Kruskal-Wallis Test for Financial Ratios of Individual Dairy Co-operatives

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	24.68	9.49	13.28	Reject H_0
Debt-To-Equity	26.63	9.49	13.28	Reject H_0
Profit Margin	35.88	9.49	13.28	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 16: Kruskal-Wallis Test for Financial Ratios of Individual Poultry and Egg Co-operatives

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	4.30	3.84	6.64	Reject H_0 at 5%
Debt-To-Equity	0.51	3.84	6.64	Maintain H_0
Profit Margin	2.21	3.84	6.64	Maintain H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 17: Kruskal-Wallis Test for Financial Ratios of Individual Fruit and Vegetable Co-operatives

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	38.54	5.99	9.21	Reject H_0
Debt-To-Equity	24.29	5.99	9.21	Reject H_0
Profit Margin	34.44	5.99	9.21	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 18: Kruskal-Wallis Test for Financial Ratios of Individual Honey and Maple Co-operatives

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	0.81	3.84	6.64	Maintain H_0
Debt-To-Equity	3.36	3.84	6.64	Maintain H_0
Profit Margin	3.43	3.84	6.64	Maintain H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 19: Kruskal-Wallis Test for Financial Ratios of Individual Grain and Oilseed Co-operatives

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	23.14	5.99	9.21	Reject H_0
Debt-To-Equity	12.48	5.99	9.21	Reject H_0
Profit Margin	35.29	5.99	9.21	Reject H_0

Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 20: Kruskal-Wallis Test for Financial Ratios of Individual Livestock Co-operatives

Financial Ratio	X^2			Decision
	Cal. H	Critical		
		5%	1%	
Current Ratio	26.27	3.84	6.64	Reject H_0
Debt-To-Equity	26.10	3.84	6.64	Reject H_0
Profit Margin	1.96	3.84	6.64	Maintain H_0

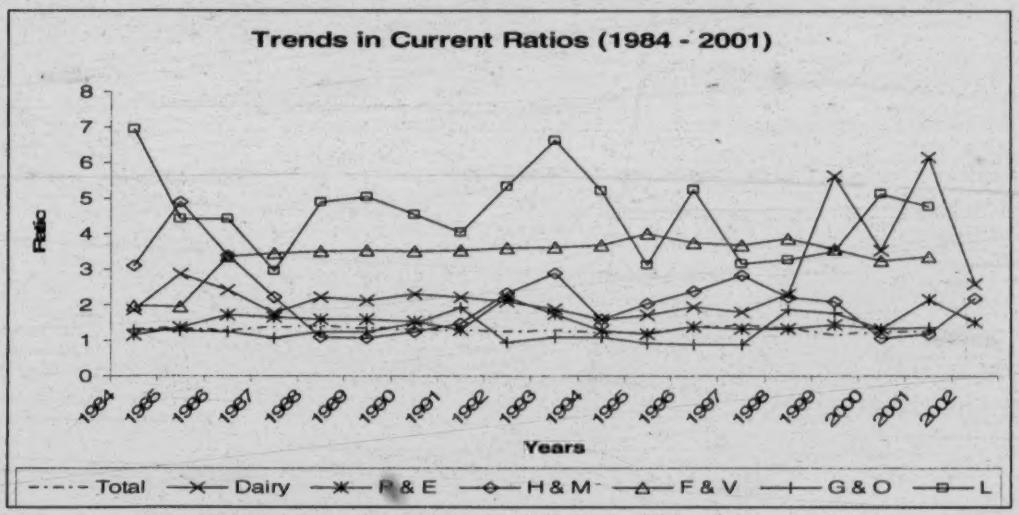
Note: Cal. H = the calculated H statistics
Critical = the critical values from the chi-square distribution table

From the results in Tables 15 to 20, it is seen that on the whole, the financial ratios of individual co-operatives in the various sub-sectors are not identical to each other, however, for the honey and maple co-operatives, all financial ratios were found to be similar among the co-operatives. The same is true for the poultry and egg co-

operatives with only the current ratio being different at the 5% level of significance. Livestock co-operatives were found to have identical profit margins. These results can be compared with the results obtained by Lerman and Parliament (1990) (their results showed that the median financial ratios of dairy co-operatives are different from that of IOFs in the same industry). The results from their Kruskal-Wallis tests showed that the median financial ratios are different for the co-operatives in all the various sub-sectors. The results obtained in this study are consistent with their results.

The average financial ratios of co-operatives in the various sub-sectors were also compared graphically to each other and also to the ratios of the total marketing co-operatives sector in Figures 7 and 8.

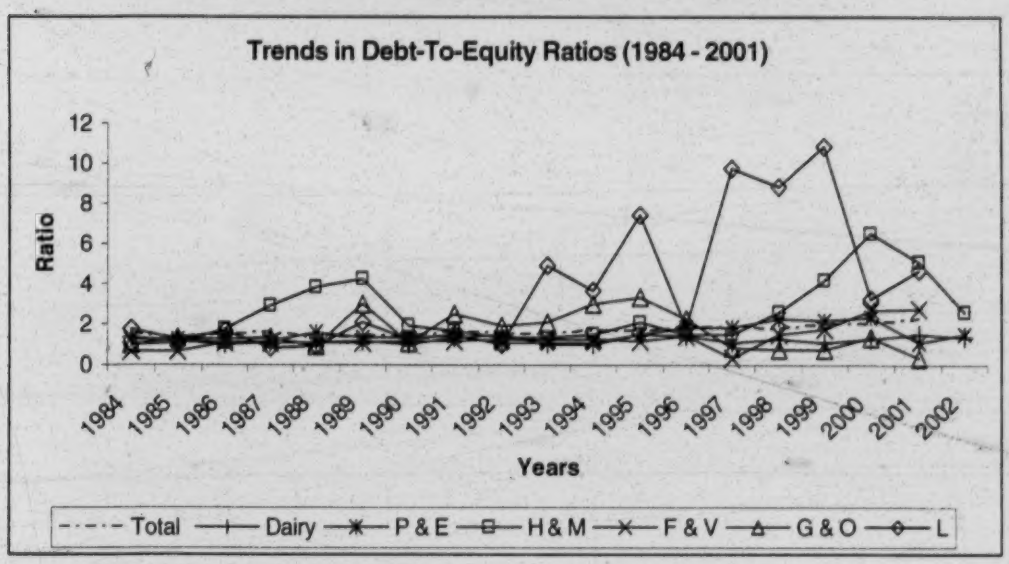
Figure 7: A Graph Comparing The Trends in Current Ratios Of The Various Sub-Sector Groups With The Total Sector (1984 – 2001)



Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Note: *Total* =Total Marketing Co-operatives
F & V = Fruits and Vegetables co-operatives
Dairy = Dairy co-operatives
P & E = Poultry and Eggs co-operatives
H & M = Honey and Maple co-operatives
G & O = Grains and Oilseeds co-operatives
L = Livestock co-operatives

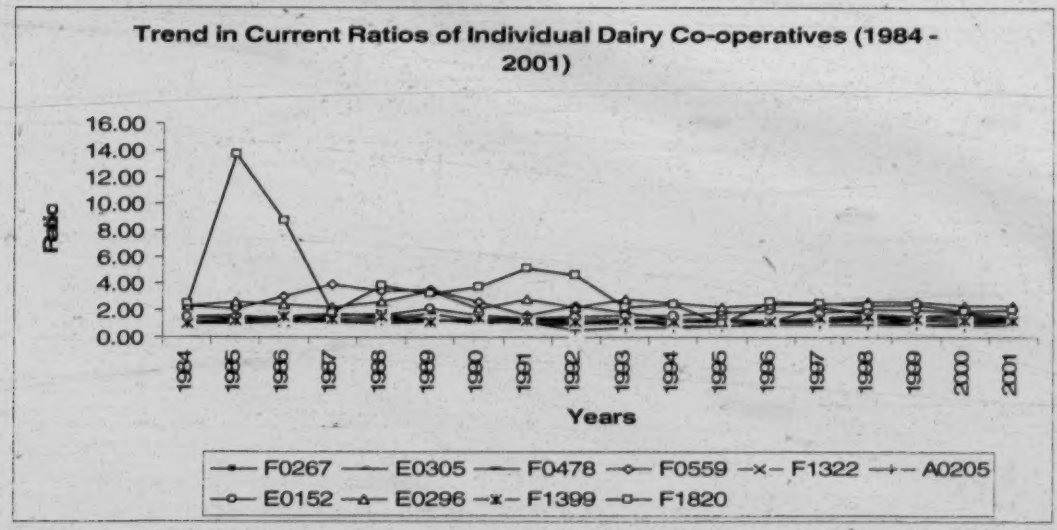
Figure 8: A Graph Comparing The Trends in Debt-To-Equity Ratios Of The Various Sub-Sector Groups With The Total Sector (1984 – 2001)



Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

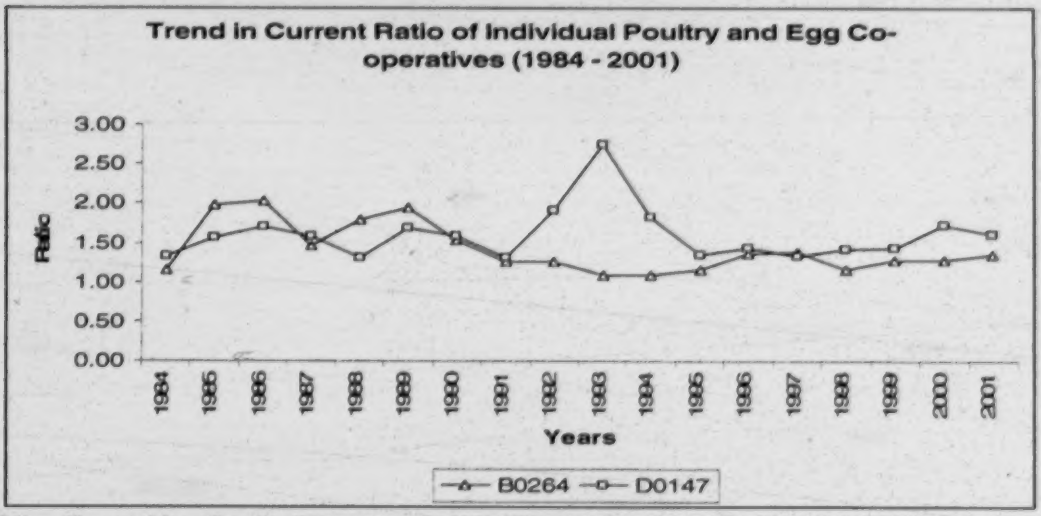
Note: *Total* =Total Marketing Co-operatives
F & V = Fruits and Vegetables co-operatives
Dairy = Dairy co-operatives
P & E = Poultry and Eggs co-operatives
H & M = Honey and Maple co-operatives
G & O = Grains and Oilseeds co-operatives
L = Livestock co-operatives

Figure 9: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Dairy Sub-Sector (1984 – 2001)



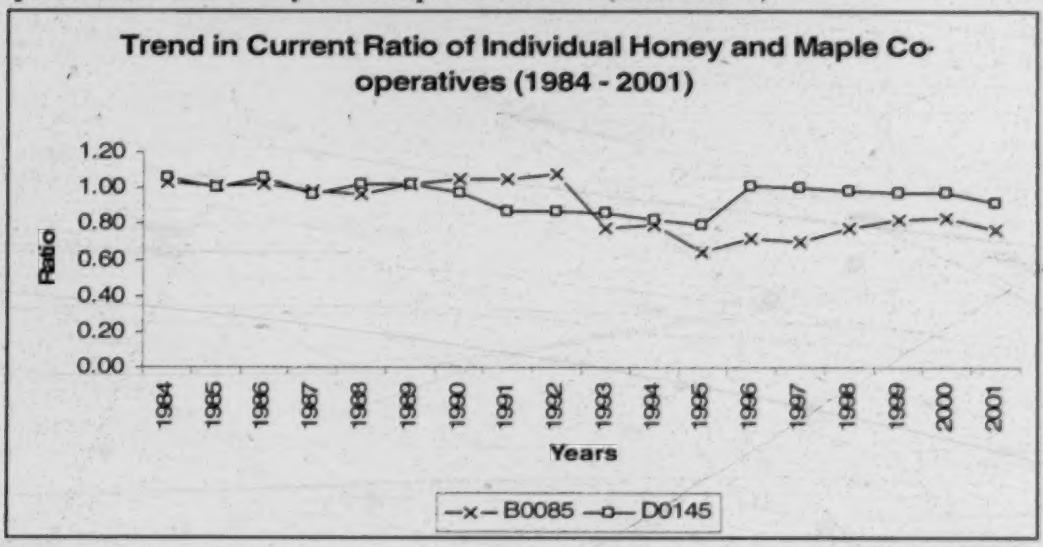
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: F0267, E0305, F0478, F0559, F1322, A0205, E0152, E0296, F1399, F1820 are codes for the individual dairy co-operatives.

Figure 10: A Graph Showing The Trend In Current Ratio Of Individual Co-operatives In The Poultry and Egg Sub-Sector (1984 – 2001)



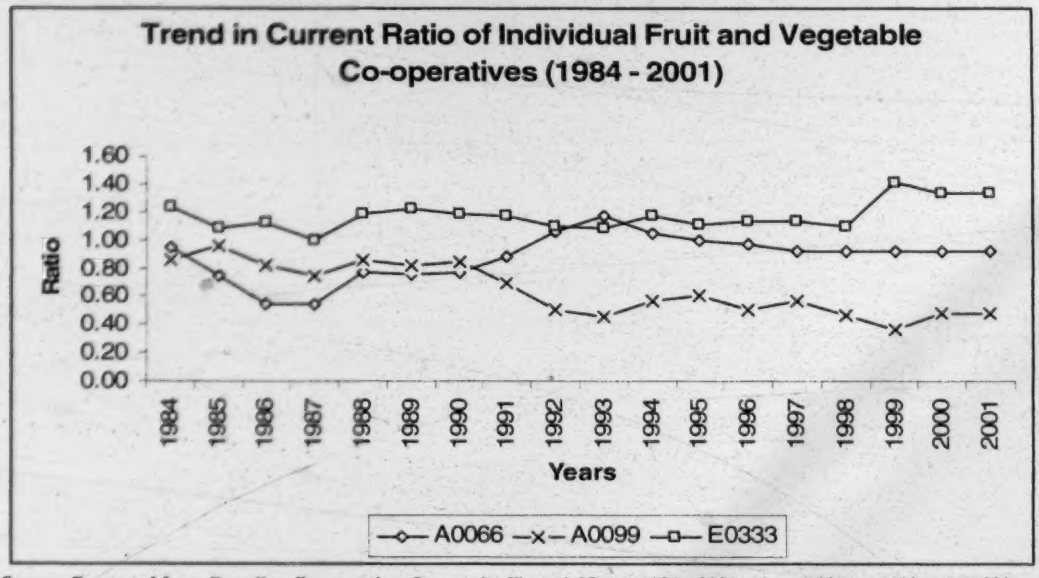
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: B0264, D0147 are codes for the individual poultry and egg co-operatives.

Figure 11: A Graph Showing The Trend In Current Ratio Of Individual Co-operatives In The Honey And Maple Sub-Sector (1984 – 2001)



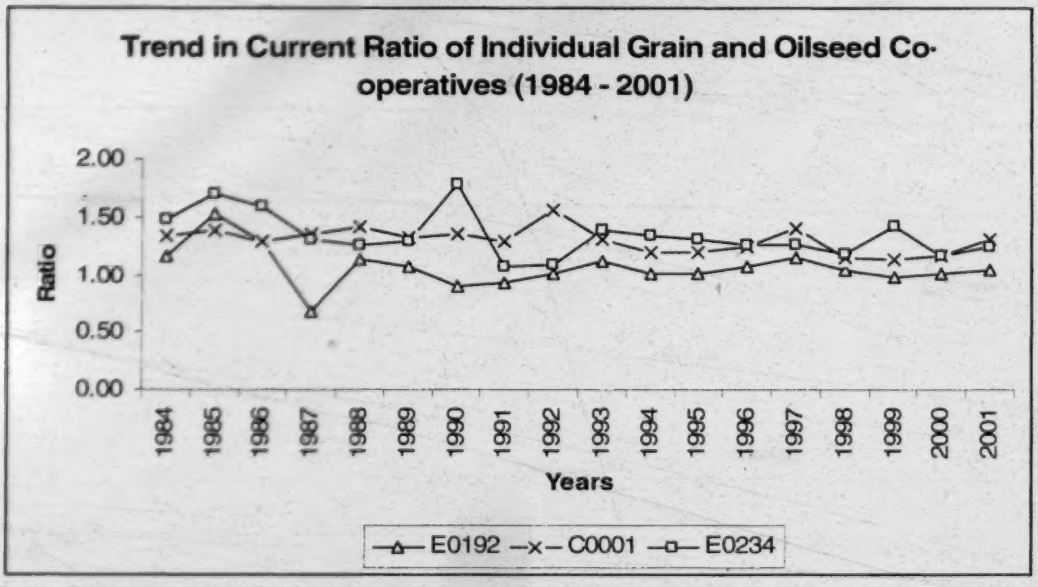
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: B00085, D0145 are codes for the individual honey and maple co-operatives.

Figure 12: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Fruit And Vegetable Sub-Sector (1984 – 2001)



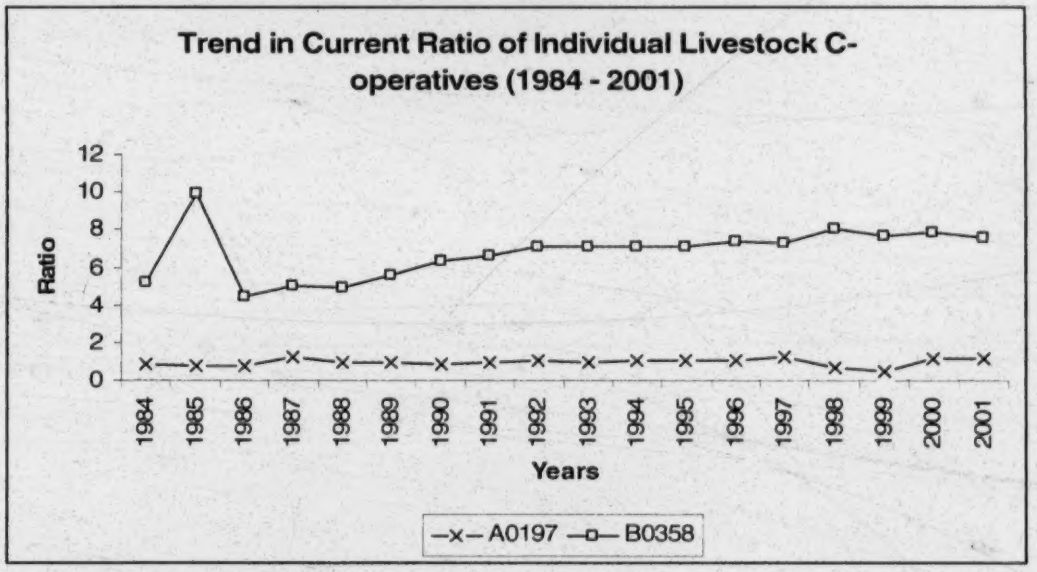
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: A0066, A0099 and E0333 are codes for the individual fruit and vegetable co-operatives.

Figure 13: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Grain And Oilseed Sub-Sector (1984 – 2001)



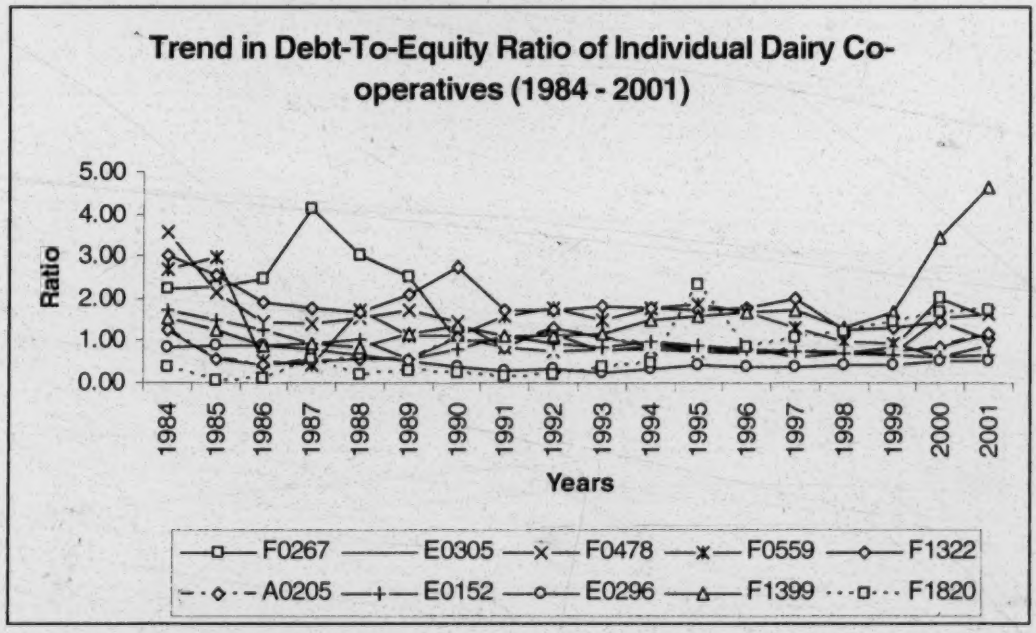
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: E0192, C0001 and E0234 are codes for the individual grain and oilseed co-operatives.

Figure 14: A Graph Showing The Trend In Current Ratio of Individual Co-operatives In The Livestock Sub-Sector(1984 – 2001)



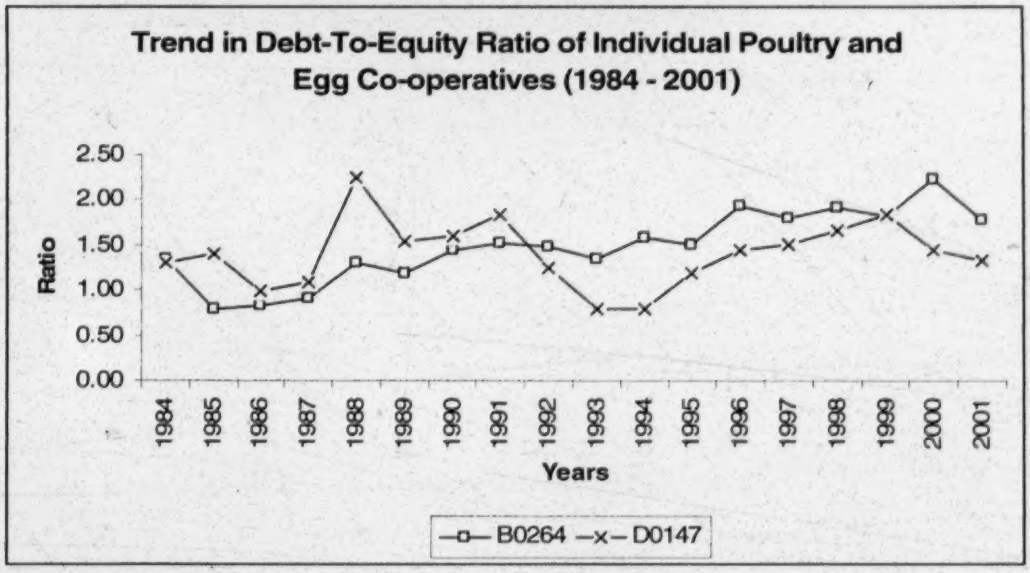
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: A0197 and B0358 are codes for the individual livestock co-operatives.

Figure 15: A Graph Showing The Trend In Debt-To-Equity Ratio of Individual Co-operatives In The Dairy Sub-Sector (1984 – 2001)



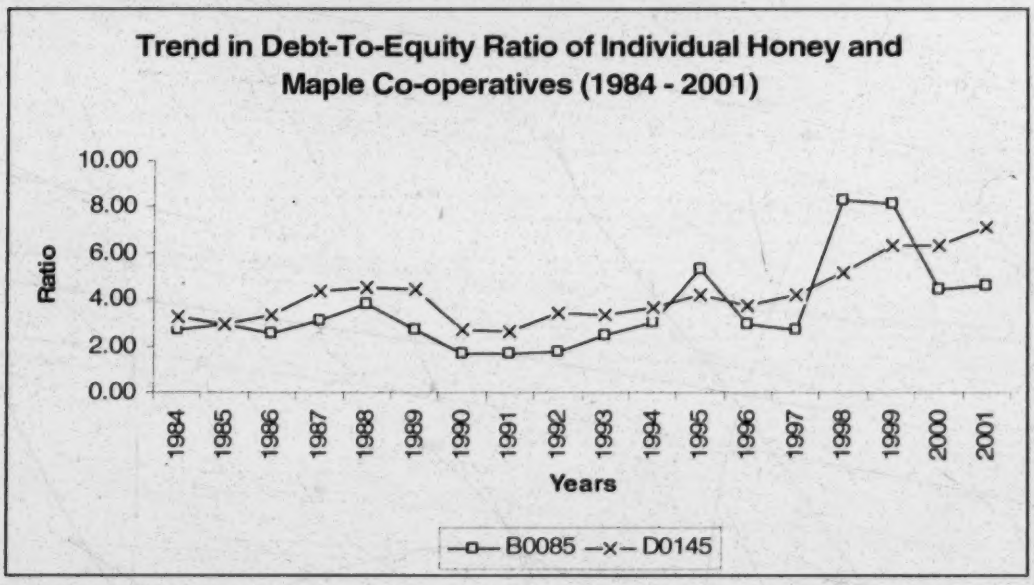
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: F0267, E0305, F0478, F0559, F1322, A0205, E0152, E0296, F1399, F1820 are codes for the individual dairy co-operatives.

Figure 16: A Graph Showing The Trend In Debt-To-Equity Ratio of Individual Co-operatives In The Poultry and Egg Sub-Sector (1984 – 2001)



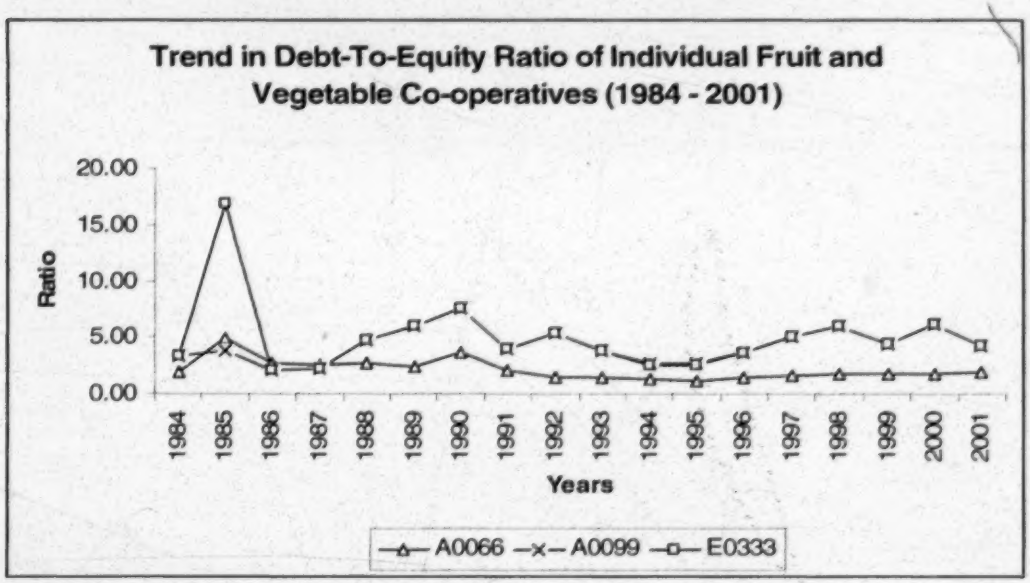
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: B0264 and D0147 are codes for the individual poultry and egg co-operatives.

Figure 17: A Graph Showing The Trend In Debt-To-Equity Ratio Of Individual Co-operatives In The Honey And Maple Sub-Sector (1984 – 2001)



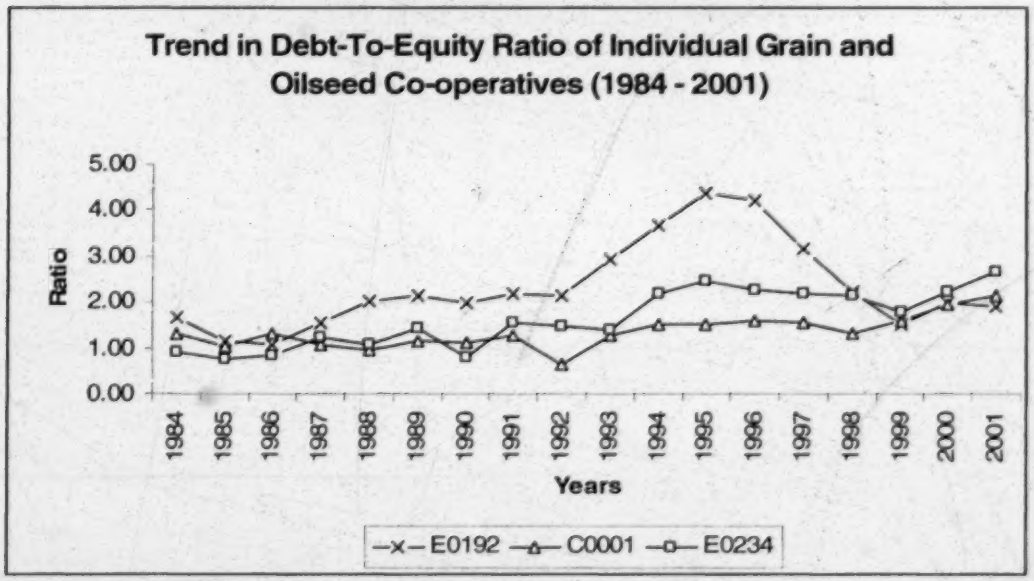
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: B00085, D0145 are codes for the individual honey and maple co-operatives.

Figure 18: A Graph Showing The Trend In Debt-To-Equity Ratio Of Individual Co-operatives In The Fruit And Vegetable Sub-Sector (1984 – 2001)



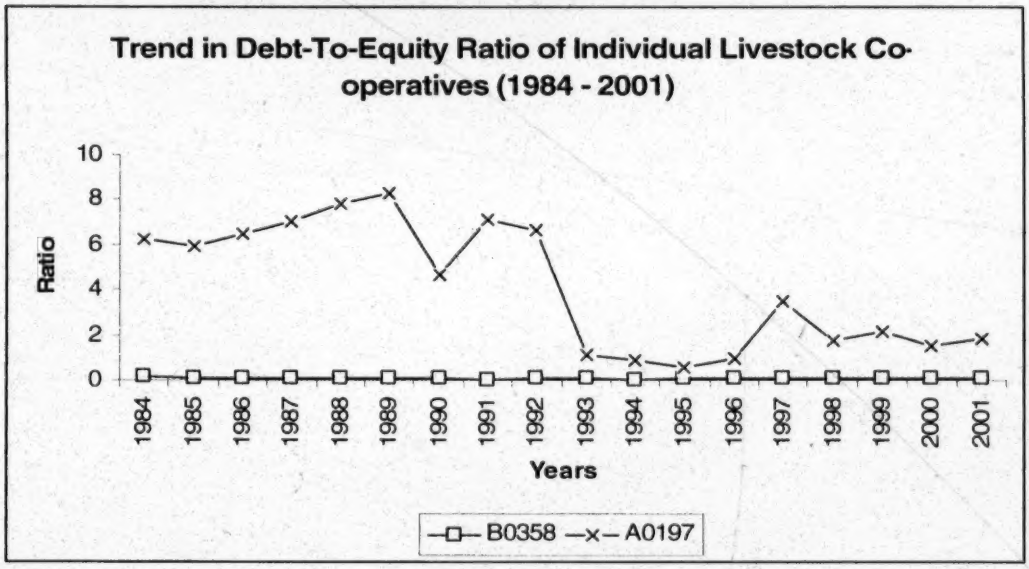
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: A0066, A0099 and E0333 are codes for the individual fruit and vegetable co-operatives.

Figure 19: A Graph Showing The Trend In Debt-To-Equity Ratio Of Individual Co-operatives In The Grain And Oilseed Sub-Sector (1984 – 2001)



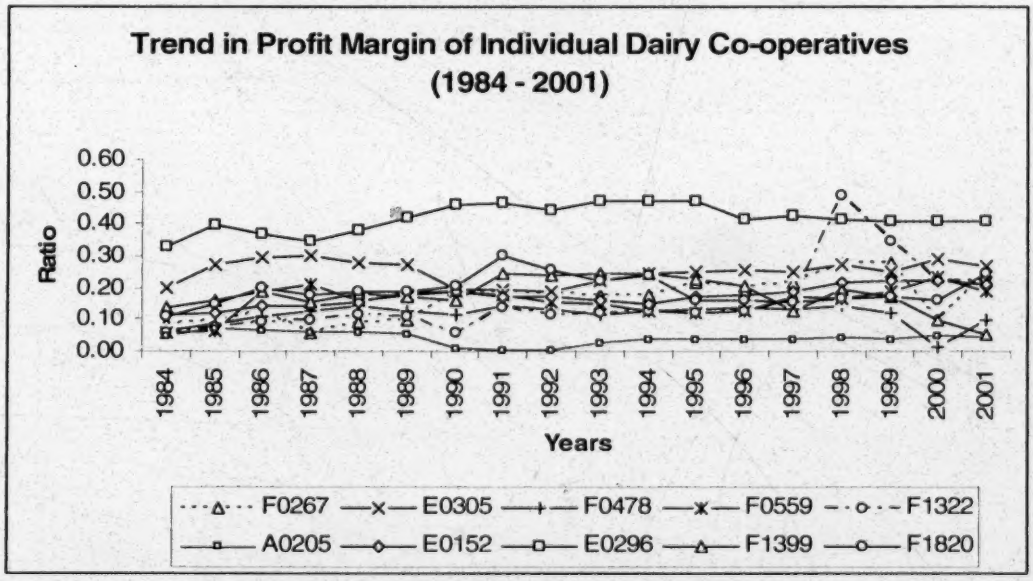
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: E0192, C0001 and E0234 are codes for the individual grain and oilseed co-operatives.

Figure 20: A Graph Showing The Trend In Debt-To-Equity Ratio of Individual Co-operatives In The Livestock Sub-Sector (1984 – 2001)



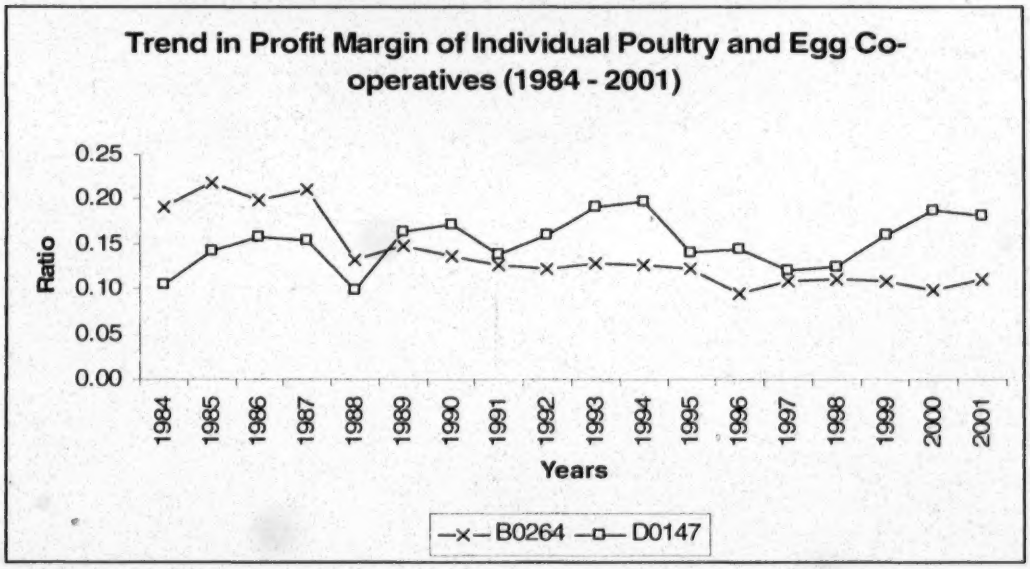
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: A0197 and B0358 are codes for the individual livestock co-operatives.

Figure 21: A Graph Showing The Trend In Profit Margin of Individual Co-operatives In The Dairy Sub-Sector (1984 – 2001)



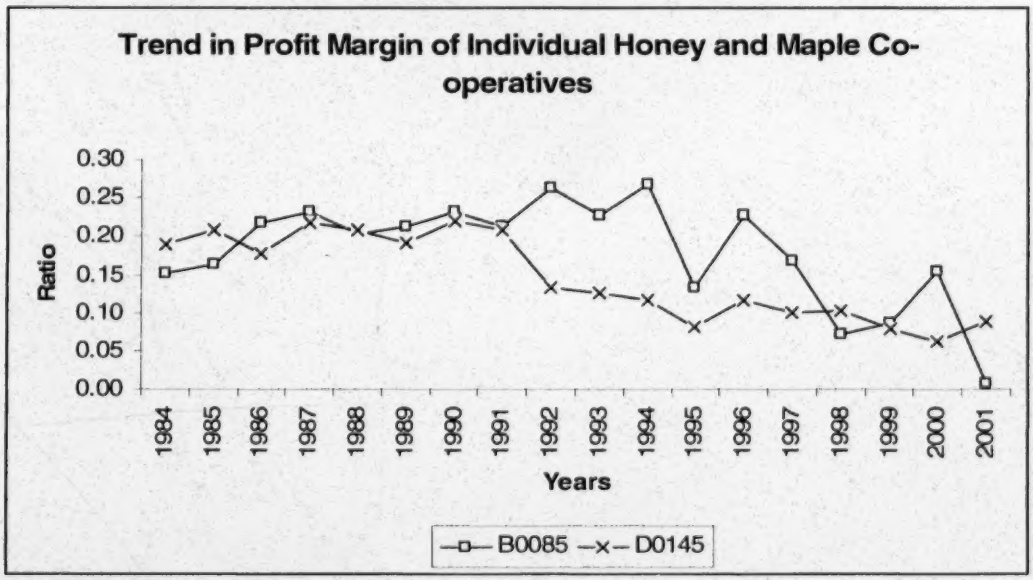
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: F0267, E0305, F0478, F0559, F1322, A0205, E0152, E0296, F1399, F1820 are codes for the individual dairy co-operatives.

Figure 22: A Graph Showing The Trend In Profit Margin Of Individual Co-operatives In The Poultry And Egg Sub-Sector (1984 – 2001)



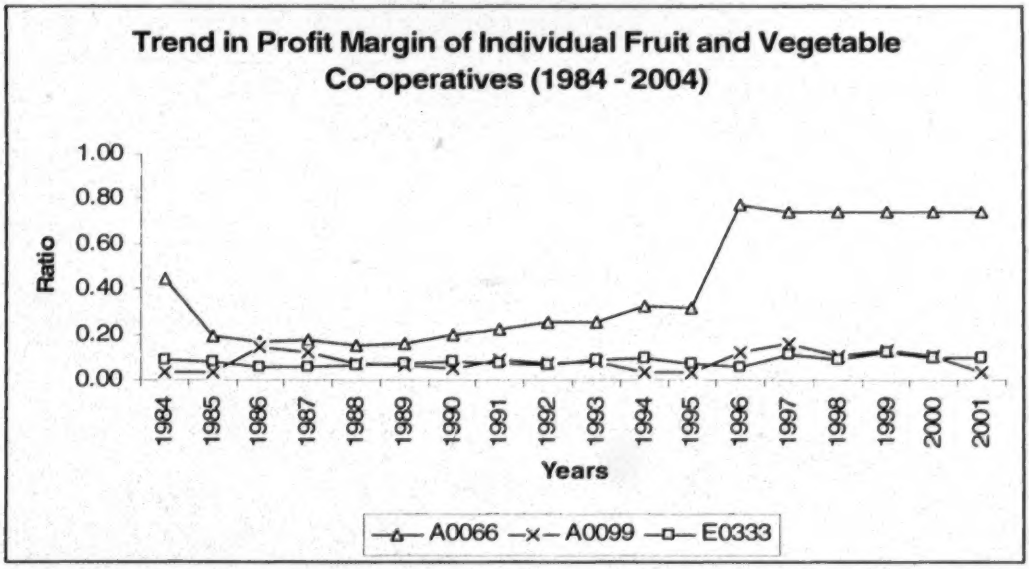
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: B0264 and D0147 are codes for the individual poultry and egg co-operatives.

Figure 23: A Graph Showing The Trend In Profit Margin of Individual Co-operatives In The Honey And Maple Sub-Sector (1984 – 2001)



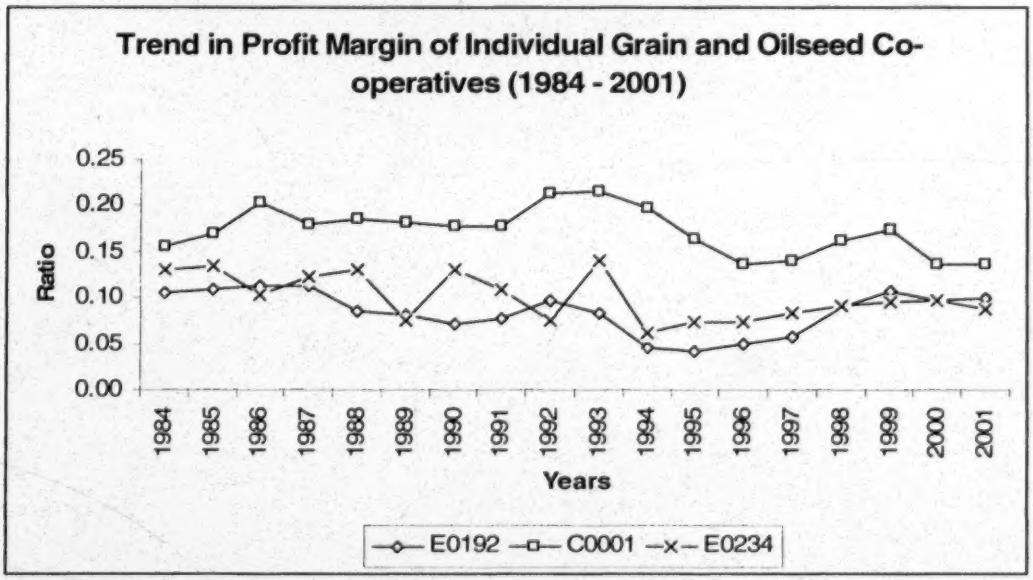
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: B00085, D0145 are codes for the individual honey and maple co-operatives.

Figure 24: A Graph Showing The Trend In Profit Margin Of Individual Co-operatives In The Fruit And Vegetable Sub-Sector (1984 – 2001)



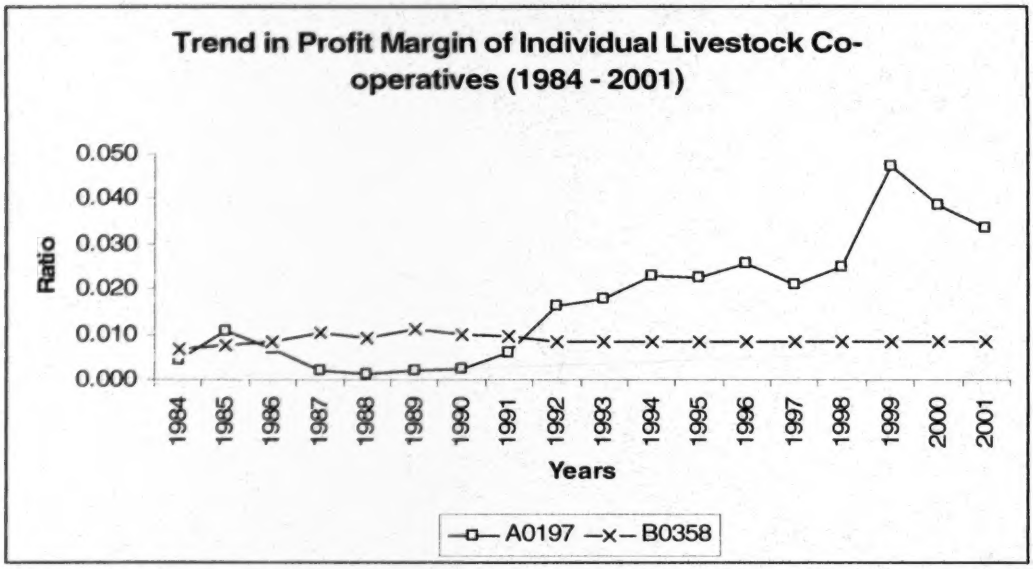
Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: A0066, A0099 and E0333 are codes for the individual fruit and vegetable co-operatives.

Figure 25: A Graph Showing The Trend In Profit Margin Of Individual Co-operatives In The Grain And Oilseed Sub-Sector (1984 – 2001)



Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: E0192, C0001 and E0234 are codes for the individual grain and oilseed co-operatives.

Figure 26: A Graph Showing The Trend In Profit Margin Of Individual Co-operatives In The Livestock Sub-Sector (1984 – 2001)



Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001). Note: A0197 and B0358 are codes for the individual livestock co-operatives.

From the comparison of the trends in the ratios over the period 1984 to 2001, it is seen that for the current ratios, the trend for the total marketing co-operatives sector was fairly constant at an average of about 1.3 (Figure 7). The dairy and poultry and eggs co-operatives, which are supply-managed, have current ratios comparable to the average current ratio of the total sector. The current ratios for the fruits and vegetables and honey and maple co-operatives are seen to fluctuate but are also higher than the total sector, with fruit and vegetable co-operatives having the highest current ratios (Figure 7). These current ratios indicate the ability of the co-operatives to finance their short term debts. The higher the current ratio, the better for the co-operative.

For the debt-to-equity ratios, the dairy, poultry and eggs, and fruit and vegetable co-operatives had ratios lower than that of the total sector (Figure 8). Honey and maple co-operatives had very high debt-to-equity ratios. This implies that the dairy, poultry and

eggs, and fruit and vegetable co-operatives are not financing their growth with debt, which could be a good strategy for growth and survival. On the other hand, it could also mean these are not growing which would not be good for these co-operatives. A high debt-to-equity ratio suggests the co-operative may eventually be in financial difficulties. In the comparisons noted above for the current ratio and the debt-to-equity ratio in Figures 7 and 8, it may be inferred that the supply-managed co-operatives have comparable ratios to that of the whole marketing co-operatives sector, but the fruits and vegetables co-operatives which are not supply-managed, have lower debt-to-equity ratios than the supply-managed co-operatives. This leads to estimation to test possible determinants in financial ratio analysis to determine how the financial ratios are affected by the various factors outlined in the previous section. The financial ratios used in this estimation are profit margin ratio, to measure profitability and current ratio, to measure liquidity.

Tables 81 to 92 in the Appendix to Chapter Four present the calculated values of the financial ratios (current ratio, debt to equity ratio and profit margin) of the individual co-operatives used in the regression analysis. The descriptive statistics for the individual co-operatives used in the estimation are reported in Table 80 in the Appendix to Chapter Four. The regression analysis was carried out for each individual co-operative using TSP version 4.5. The results obtained from the regressions are outlined and discussed in the next sub-sections.

4.3.1 Profit Margin Results

Profit margin was used as a measure of profitability in this study because it reflects the profit generating ventures of the co-operative and is an acceptable indicator of

performance. The profit margin regression results of the various individual co-operatives are presented in Tables 21 to 25. The double logarithmic form of the model was used; thus the coefficients on the independent variables can be interpreted as elasticities. Correlations between the variables in regression ware checked to verify if there is multicollinearity. These correlations did not indicate multicollinearity in the regressions.

Table 21: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Dairy Sub-sector

Dependent Variable: Profit Margin

Identifier	*F0267*	*E0305*	*F0478*	*F0559*	*F1322*	*A0205*	*E0152*	*E0296*	*F1399*	*F1820*
Constant	-12.02	16.43*	15.18	51.22***	-31.10***	-35.59***	-0.84	-29.05*	-19.56**	12.84
	(11.41)	(8.45)	(26.45)	(15.54)	(6.91)	(9.21)	(17.81)	(15.07)	(7.55)	(9.33)
Time Trend	0.04	0.45**	0.71***	1.75***	-0.21**	-0.24	-0.10	-0.15*	-0.19	-0.49
	(0.19)	(0.19)	(0.20)	(0.44)	(0.10)	(0.19)	(0.10)	(0.09)	(0.37)	(0.55)
Membership Size	-0.33	-0.08	1.40***	-0.22	0.34	0.45***	-2.08	5.04*	-0.35	-0.04
	(0.30)	(0.09)	(0.51)	(0.50)	(0.29)	(0.12)	(2.57)	(3.09)	(0.60)	(0.87)
Profit Margin(-1)	0.51***	0.86***	0.95*	0.11	0.19	0.81***	0.09	0.32	0.19	0.51*
	(0.14)	(0.32)	(0.56)	(0.46)	(0.18)	(0.16)	(0.29)	(0.23)	(0.27)	(0.31)
Firm Size	1.37***	-1.17***	2.55***	1.23**	1.62***	1.84***	1.22**	1.03**	1.15***	0.81*
	(0.39)	(0.37)	(0.94)	(0.51)	(0.19)	(0.29)	(0.51)	(0.38)	(0.34)	(0.50)
Financial Leverage	-1.04***	-0.76***	1.17**	-0.15	-1.18***	-1.41***	-0.66***	-0.45***	-1.04***	-0.34**
	(0.12)	(0.20)	(0.53)	(0.22)	(0.13)	(0.20)	(0.19)	(0.09)	(0.19)	(0.14)
Input Price	0.23	0.14	0.76	3.07	0.65	-3.98***	0.35	-1.04	-1.60	6.72***
	(2.20)	(1.30)	(1.74)	(3.94)	(1.12)	(1.26)	(1.85)	(0.75)	(2.55)	(4.89)
Co-op Market Share	-0.90***	-0.31	0.18	-0.83*	-0.92***	-1.64***	-0.31*	0.19	-0.63**	0.42
	(0.29)	(0.44)	(0.59)	(0.43)	(0.12)	(0.41)	(0.18)	(0.14)	(0.24)	(0.46)
Market Concentration	0.49	-0.15	-0.11	0.13	0.23	-0.30	0.01	-0.24	0.39	0.13
	(0.31)	(0.13)	(0.17)	(0.27)	(0.44)	(0.20)	(0.15)	(0.17)	(0.29)	(0.29)
R^2	0.97	0.92	0.94	0.92	0.99	0.99	0.96	0.94	0.97	0.88
Adjusted R^2	0.93	0.80	0.80	0.80	0.98	0.98	0.89	0.85	0.91	0.69
F	24.01***	7.24***	6.64***	7.50***	133.57***	85.50***	13.59***	9.91***	17.63***	4.52***
Durbin's h	-3.06**	-2.43**	3.30***	0.84	0.04	2.75**	-1.17	-1.14	0.08	-0.63

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 22: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Poultry And Egg And Honey And Maple Sub-sectors

Dependent Variable: Profit Margin

Identifier	Poultry and Egg		Honey and Maple	
	B0264	*D0147*	*B0085*	*D0145*
Constant	-3.38	19.11**	-6.39	-13.72*
	(3.20)	(8.40)	(4.98)	(8.30)
Time Trend	-0.11	-0.40**	0.04	-0.20
	(0.10)	(0.15)	(0.11)	(0.15)
Membership Size	-0.38***	-0.62**	-0.37	-0.30
	(0.13)	(0.18)	(0.38)	(0.45)
Profit Margin(-1)	0.12	0.17	0.04	0.09
	(0.11)	(0.17)	(0.09)	(0.21)
Firm Size	0.72***	1.12***	1.11***	1.50***
	(0.16)	(0.21)	(0.20)	(0.54)
Financial Leverage	-0.84***	-0.60***	-0.85***	-1.48***
	(0.10)	(0.12)	(0.06)	(0.36)
Input Price	-0.15	-1.48*	-0.59	-0.94*
	(0.23)	(0.92)	(0.63)	(0.57)
Co-op Market Share	0.54*	-0.53	-0.53**	-1.08***
	(0.28)	(0.49)	(0.24)	(0.57)
Market Concentration	0.14	-0.62	-1.20*	-0.12
	(0.18)	(0.42)	(0.68)	(0.49)
R^2	0.99	0.98	0.99	0.96
Adjusted R^2	0.99	0.95	0.98	0.91
F	193.58***	27.76***	149.63***	19.99***
Durbin's h	-2.54***	-1.46	-2.93***	-2.76***

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 23: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Fruit And Vegetable Sub-sector

Dependent Variable: Profit Margin

Identifier	*A0066*	*A0099*	*E0333*
Constant	11.16	-7.41	-19.92**
	(59.27)	(14.43)	(9.85)
Time Trend	-1.34	-1.30*	0.19
	(1.26)	(0.75)	(0.24)
Membership Size	-1.66	-1.42	1.37
	(1.87)	(1.40)	(1.21)
Profit Margin(-1)	0.81***	0.20	0.07
	(0.29)	(0.20)	(0.20)
Firm Size	0.62	-0.38	-0.49*
	(2.55)	(0.91)	(0.25)
Financial Leverage	-1.43*	-0.95***	0.21
	(0.77)	(0.15)	(0.25)

Input Price	-1.44	-16.20	3.39
	(1.87)	(12.82)	(4.29)
Co-op Market Share	1.39	-0.07	-1.15***
	(1.07)	(0.91)	(0.21)
Market Concentration	-0.73	0.21	0.43
	(0.57)	(1.06)	(0.32)
R^2	0.98	0.96	0.96
Adjusted R^2	0.92	0.85	0.88
F	15.81***	8.34***	10.50***
Durbin's h	-2.49**	2.18**	-3.71***

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations

Table 24: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Grain And Oilseed Sub-sector

Dependent Variable: Profit Margin

Identifier	***E0192***	***C0001***	***E0234***
Constant	-3.11	-3.04	-26.89***
	(4.14)	(20.59)	(5.34)
Time Trend	0.32**	-0.14	-0.14
	(0.15)	(0.09)	(0.12)
Membership Size	-0.76	-0.18	0.51
	(0.66)	(1.40)	(0.40)
Profit Margin(-1)	0.44*	0.29	0.02
	(0.27)	(0.31)	(0.15)
Firm Size	0.68*	0.98***	1.75***
	(0.41)	(0.31)	(0.30)
Financial Leverage	-0.82***	-0.53***	-0.52***
	(0.17)	(0.17)	(0.16)
Input Price	0.25	-0.23	-0.25
	(0.27)	(0.28)	(0.31)
Co-op Market Share	-0.53**	-0.17	-1.29***
	(0.21)	(0.42)	(0.25)
Market Concentration	-0.68	-0.31	-0.26
	(0.51)	(0.30)	(0.32)
R^2	0.97	0.91	0.93
Adjusted R^2	0.93	0.80	0.84
F	21.70***	8.04***	11.05***
Durbin's h	3.31***	-1.73*	-0.86

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations

Table 25: Regression Results Of Profit Margin Analysis Of Individual Co-operatives In The Livestock Sub-sector

Dependent Variable: Profit Margin

Identifier	*A0197*	*B0358*
Constant	22.15	-5.46**
	(71.46)	(2.36)
Time Trend	0.16	0.05
	(0.51)	(0.04)
Membership Size	-6.38	0.69***
	(9.26)	(0.14)
Profit Margin(-1)	0.08	0.42***
	(0.37)	(0.13)
Firm Size	1.44***	1.35***
	(0.49)	(0.16)
Financial Leverage	-0.98***	0.23**
	(0.28)	(0.10)
Input Price	-2.46	-0.05
	(2.48)	(0.10)
Co-op Market Share	-0.08	0.005
	(0.15)	(0.006)
Market Concentration	-2.46***	0.03
	(0.84)	(0.05)
R^2	0.97	0.99
Adjusted R^2	0.92	0.97
F	21.48***	65.92***
Durbin's h	-2.11**	-1.54

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviation

On the whole, comparing the magnitude of the coefficients on financial leverage for the supply-managed co-operatives with that of the other co-operatives, it is seen that financial leverage of the supply-managed co-operatives is less 'elastic' than for non supply-managed co-operatives. This implies that the profit margin of supply-managed co-operatives does not change much with a change in their financial leverage, compared with their non supply-managed counterparts. From the results in Table 21, it is seen that financial leverage was found to be negative and significant for nine individual co-operatives in the dairy sub-sector. This means that financial leverage has a negative impact on the profit margin of the dairy co-operatives. This is consistent with a priori expectations. In Table 22, the coefficients on financial leverage were found to be negative and significant for the poultry and egg and honey and maple co-operatives. The same is true for grain and oilseed co-operatives in Table 24. On average, the magnitudes of the estimated coefficients on financial leverage explaining profit margin for poultry and eggs co-operatives were found to be larger than those for the dairy co-operatives. This may mean that the profit margin of poultry and eggs co-operatives is more responsive to financial leverage than that of dairy cooperatives. The magnitudes of the coefficients on financial leverage of the honey and maple co-operatives were larger than those of the dairy and poultry and egg co-operatives. In Table 23, two of the fruit and vegetable co-operatives had negative and significant coefficients on financial leverage. Table 25 shows one livestock co-operative had a negative and significant coefficient on financial leverage and the other had a positive and significant coefficient on financial leverage.

A positive coefficient on time trend may suggest that profit margin of the co-operative has been increasing. A negative coefficient on time trend may suggest that the decisions that are made by managers or management of co-operatives may not be seen as positive profit margin over the period of time studied. Decisions made may change from time to time and these decisions may affect the profit margin of the co-operative over time. The coefficients on time trend for dairy co-operatives profit margin were found to be significant for five co-operatives; three had positive effects on profit margin and two had negative effects. Only one of the poultry and eggs co-operatives had a negative and significant coefficient on time trend. Time trend was not significant for honey and maple and livestock co-operatives. With the fruit and vegetable co-operatives, two co-operatives had negative and significant coefficients on time trend. With the grain and oilseed co-operatives, only one co-operative had a positive and significant coefficient on time trend. These results show that even in the same sector co-operatives may react differently to the same effect.

A positive effect of firm size on profit margin implies that as the co-operative grows in size, its profit margin also increases. This may be due to the fact that as the size of the co-operative grows, it has a larger clientele base and so it makes more profit and thus profit margin increases. On the other hand, a negative effect of firm size on profit margin may be explained that as the firm grows, its objectives may become diverse as there may be other needs associated with the growth and so the co-operative may not focus on profit making solely. In explaining profit margin, the coefficients on firm size of dairy co-operatives as explanatory variable were found to be positive and significant for nine co-operatives; only one co-operative had a negative and significant coefficient on

firm size explaining profit margin. The coefficients on firm size for both poultry and egg co-operatives were found to be positive and significant and the measures were more elastic as compared to that of dairy co-operatives. This may mean that profit margin of poultry and eggs co-operatives responds quicker to a change in firm size than dairy co-operatives do. For the honey and maple co-operatives, both had positive and significant coefficients on firm size; the same is true for the grain and oilseed and livestock co-operatives. Only one fruit and vegetable co-operative had a negative and significant coefficient of firm size as explanation of profit margin. The magnitudes of the coefficients of firm size of the livestock co-operatives were relatively larger than the other co-operatives.

A negative effect of membership size on profit margin may imply that the larger the number of members in the co-operative, the more likely will the co-operative be to have diverse interests and opinions from its members (i.e. horizon problem). Since the members may have diverse interests, the co-operative may not be able to pursue profit generating ventures and this may lead to low profit margins. A positive coefficient on membership size may mean that the more members there are in a co-operative, the more will the co-operative be interested in making profit to maximize members' welfare. Membership size of co-operatives had both negative and positive effects on profit margins for different co-operative sub-sector groups. In the dairy co-operatives sub-sector, three co-operatives had significant and positive coefficients of membership size. The coefficients of membership size for poultry and egg co-operatives were negative in explaining profit margins. None of the fruit and vegetable, honey and maple and grain

and oilseed co-operatives had significant effect on membership size. One livestock co-operative had a positive and significant coefficient of membership size.

The effect of input price, which is used to proxy regulation, did not on the whole have significant effects on profit margin for most of the co-operatives: whether supply-managed or non supply-managed. For the dairy co-operatives, only two co-operatives had significant coefficients on input price. The negative relationship between input price and profit margin may mean that as the input price increases, profit margin decreases. If supply management is to have a positive effect on members of co-operatives, it follows that input price would have a negative effect on profit margin of the co-operative. For the poultry and eggs co-operatives, one co-operative had a negative coefficient on input price; the same is true for honey and maple co-operatives. For grain and oilseed co-operatives, none of the co-operatives had a significant coefficient on input price. This may be due to the fact that the grains being handled by co-operatives are owned by the Canadian Wheat Board and not the co-operatives. Input price of co-operatives is the price that co-operatives pay to producers for their produce. The results showed that input price did not have a significant effect on the profit margin of most co-operatives; both supply-managed and non supply-managed co-operatives. Higher input prices may not necessarily result in losses due to inefficiency.

For the lagged dependent variable, the sign on the lagged dependent variable should be positive as this variable is incorporated in the model to capture partial adjustment. That is, profit margin in the previous year is expected to have a positive effect on the profit margin in the present year. For the dairy co-operatives, it was found that the coefficient on profit margin in the previous year was positive and significant for

five co-operatives. For the poultry and egg and honey and maple co-operatives, none of the co-operatives had significant coefficients on the lagged dependent variable. One co-operative each from fruit and vegetable, grain and oilseed and livestock sub-sectors had positive and significant coefficients on the lagged profit margin.

The effect of individual co-operative's market share on profit margin was also assessed through regression analysis. The market share of an individual co-operative gives an idea of that co-operative's control in the market. A negative effect of market share on profit margin would imply that as the market share of an individual co-operative increase its profit margin decreases, and vice versa. For the dairy co-operatives, the regression for six co-operatives showed negative and significant coefficients on their market share variable as an explanation of profit margin. None of the poultry and egg and livestock co-operatives had significant coefficients on the market share variable as an explanator of profit margin. Both honey and maple co-operatives had negative and significant coefficients on their market share variable. One fruit and vegetable co-operative had a negative and significant coefficient on market share. For the grains and oilseeds co-operatives, two co-operatives had negative and significant coefficients on their market share. The negative effect of individual co-operative market share may be explained as that, if a co-operative has a large market share, it means that, that co-operative is a big co-operative and thus some co-operatives tend to have lower profit margin as they become bigger and vice versa.

The effects of sector market concentration on profit margins were also assessed in the analysis. The Herfindahl index of each sector was used as a measure of market concentration in the sectors and regressed against profit margin. On the whole, the effect

of market concentration was not significant for most co-operatives. One co-operative each from the honey and maple and livestock sub-sectors had negative and significant coefficients on market concentration as explanations of profit margins. A negative coefficient on market concentration implies that as the market concentration in the sector increases (this may be due to fewer firms in the industry), the profit margin of a co-operative in that sector decreases. It may be that with the entry of new co-operatives into the sector, the competition in the market now becomes stronger and so profits will decrease. On the other hand, a positive effect of market concentration on profit margin could be due to efficient allocation of resources by the individual co-operative due to increased competition and this may result in increased profitability.

From the results above, it may be inferred that supply-managed and non supply-managed co-operatives are performing comparably to each other. The results obtained in this study are consistent with the findings made of Katz (1985) that firm size and membership size have an effect on productivity (in this case, profit margin). The results are also consistent with findings by Fama and French (1993) and Slade (2003).

Table 26: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Dairy Sub-sector

Dependent Variable: Current Ratio

Identifier	*F0267*	*E0305*	*F0478*	*F0559*	*F1322*	*A0205*	*E0152*	*E0296*	*F1399*	*F1820*
Constant	-9.68	-40.36*	3.75	-11.74	-13.17	-49.66**	31.69**	-52.12	-2.66	-32.38*
	(16.11)	(23.38)	(5.66)	(21.99)	(13.92)	(24.26)	(14.04)	(76.95)	(15.62)	(19.74)
Time Trend	-0.72***	-0.31***	0.22**	-0.30**	-0.10**	-0.28**	0.07***	-0.03	-0.05	-0.04
	(0.18)	(0.10)	(0.09)	(0.11)	(0.05)	(0.11)	(0.02)	(0.15)	(0.09)	(0.19)
Membership Size	-0.65*	-0.04	0.29	-0.66*	0.45	-0.09	-0.06	12.66	0.05	1.69**
	(0.36)	(0.17)	(0.31)	(0.38)	(0.37)	(0.22)	(1.83)	(13.19)	(0.35)	(0.79)
Current Ratio(-1)	0.73	0.44	-0.03	0.03	0.31	0.22	0.16	0.74*	0.43	0.26
	(0.51)	(0.28)	(0.31)	(0.26)	(0.43)	(0.36)	(0.31)	(0.38)	(0.39)	(0.26)
Firm Size	0.49*	1.49***	-0.44***	1.98***	0.54	0.22	-1.19***	1.66	0.07	0.01
	(0.27)	(0.72)	(0.15)	(0.68)	(0.55)	(0.50)	(0.23)	(2.27)	(0.26)	(0.47)
Financial Leverage	-0.46***	-0.66**	-0.20***	-0.26*	-0.81**	-0.83***	0.11	-0.34	-0.32*	-0.88***
	(0.18)	(0.27)	(0.07)	(0.14)	(0.38)	(0.30)	(0.14)	(0.47)	(0.18)	(0.17)
Input Price	1.82	12.15***	-1.14	10.95***	1.32	5.07	1.51	3.95	3.32	-0.15
	(2.56)	(3.50)	(0.88)	(3.90)	(1.91)	(3.51)	(1.51)	(4.01)	(2.30)	(5.31)
Co-op Market Share	-0.06	-1.77*	-0.44*	-0.72**	-0.36**	0.03	-0.27*	-0.18	0.24	1.28*
	(0.39)	(1.04)	(0.26)	(0.33)	(0.16)	(0.85)	(0.14)	(0.45)	(0.26)	(0.78)
Market Concentration	-0.32	-0.05	0.12	-0.67*	1.03**	-0.32	-0.26**	-0.97	-0.12	-0.07
	(0.36)	(0.37)	(0.11)	(0.36)	(0.41)	(0.39)	(0.12)	(0.78)	(0.27)	(0.32)
R^2	0.85	0.85	0.89	0.94	0.76	0.85	0.93	0.52	0.71	0.97
Adjusted R^2	0.61	0.59	0.70	0.87	0.36	0.61	0.83	0.27	0.23	0.91
F	3.53***	3.31***	4.76***	11.27***	1.88*	3.45***	8.95***	0.65	1.48	15.52***
Durbin's h	-2.02**	-1.70*	-1.25	2.13**	-0.67	-2.49**	-1.77*	-0.53	-0.87	-2.26**

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 27: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Poultry And Egg And Honey And Maple Sub-sectors

Dependent Variable: Current Ratio

Identifier	Poultry and Egg		Honey and Maple	
Identifier	B0264	D0147	B0085	D0145
Constant	-12.66	-15.33	2.49	-9.60
	(11.20)	(64.32)	(4.79)	(6.79)
Time Trend	-0.17	0.21	-0.37**	0.13
	(0.31)	(0.56)	(0.19)	(0.17)
Membership Size	1.11**	0.69	-0.67**	0.16
	(0.47)	(1.40)	(0.32)	(0.28)
Current Ratio(-1)	0.06	1.05	0.24	0.04
	(0.24)	(0.93)	(0.47)	(0.35)
Firm Size	-0.59	0.17	-0.69***	0.49*
	(0.66)	(0.92)	(0.23)	(0.30)
Financial Leverage	-0.07	-2.28	-0.02	-0.19
	(0.34)	(1.87)	(0.06)	(0.22)
Input Price	1.43*	-2.80*	-0.79	0.80*
	(0.75)	(1.74)	(0.52)	(0.43)
Co-op Market Share	-1.48*	-2.06	-0.22	0.10
	(0.88)	(2.26)	(0.29)	(0.17)
Market Concentration	-1.00**	0.32	0.08	-0.51**
	(0.48)	(2.02)	(0.40)	(0.23)
R^2	0.97	0.76	0.93	0.78
Adjusted R^2	0.88	0.46	0.84	0.41
F	10.98***	1.09	9.29***	2.12**
Durbin's h	-0.75	-7.96***	-0.78	-2.11**

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations

Table 28: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Fruit And Vegetable Sub-sector

Dependent Variable: Current Ratio

Identifier	*A0066*	*A0099*	*E0333*
Constant	22.30	-7.29	-8.69*
	(32.07)	(10.62)	(5.42)
Time Trend	0.64*	0.13	-0.48**
	(0.33)	(0.33)	(0.20)
Membership Size	0.47	0.003	-1.33
	(0.46)	(0.69)	(0.86)
Current Ratio(-1)	0.32	0.29	0.97**
	(0.37)	(0.53)	(0.47)
Firm Size	-0.76**	0.76**	0.34**
	(0.33)	(0.31)	(0.14)
Financial Leverage	0.42	0.09	-0.09
	(0.59)	(0.08)	(0.17)
Input Price	-0.77**	-0.09	-0.34

	(0.34)	(0.55)	(3.31)
Co-op Market Share	0.07	0.26	-0.47**
	(0.27)	(0.53)	(0.22)
Market Concentration	0.42	0.54	0.10
	(0.28)	(0.48)	(0.25)
R^2	0.93	0.97	0.86
Adjusted R^2	0.81	0.77	0.43
F	7.98***	6.48***	1.99**
Durbin's h	-2.20**	-1.94*	-0.69

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations

Table 29: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Grain And Oilseed Sub-sector

Dependent Variable: Current Ratio

Identifier	***E0192***	***C0001***	***E0234***
Constant	-10.56	57.30***	2.93
	(7.89)	(18.22)	(2.81)
Time Trend	-0.23	-0.09	-0.04
	(0.37)	(0.06)	(0.08)
Membership Size	-1.29	-3.45***	0.26
	(1.53)	(1.18)	(0.29)
Current Ratio(-1)	0.15	0.27	0.18
	(0.41)	(0.36)	(0.18)
Firm Size	0.99*	-0.72***	-0.31*
	(0.55)	(0.23)	(0.17)
Financial Leverage	-0.24	0.03	-0.48***
	(0.32)	(0.11)	(0.13)
Input Price	0.09	-0.27*	0.23
	(0.70)	(0.16)	(0.24)
Co-op Market Share	-0.73	-0.12	0.31**
	(0.47)	(0.29)	(0.14)
Market Concentration	0.18	0.04	-0.32
	(0.60)	(0.17)	(0.24)
R^2	0.59	0.89	0.87
Adjusted R^2	-0.14	0.74	0.71
F	0.80	6.10***	5.30***
Durbin's h	3.02***	-2.31**	-1.85*

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations

Table 30: Regression Results Of Current Ratio Analysis Of Individual Co-operatives In The Livestock Sub-sector

Dependent Variable: Current Ratio

Identifier	*A0197*	*B0358*
Constant	-28.33	-5.17***
	(32.14)	(0.31)
Time Trend	0.009	-0.009
	(0.26)	(0.01)
Membership Size	3.94	0.12***
	(4.30)	(0.04)
Current Ratio(-1)	0.03	0.07***
	(0.21)	(0.01)
Firm Size	0.45**	0.25***
	(0.23)	(0.04)
Financial Leverage	-0.05	-0.80***
	(0.10)	(0.02)
Input Price	-1.20	-0.008
	(1.43)	(0.03)
Co-op Market Share	0.17***	0.002
	(0.05)	(0.002)
Market Concentration	0.98**	-0.02
	(0.44)	(0.01)
R^2	0.82	0.99
Adjusted R^2	0.59	0.99
F	3.59***	253.79***
Durbin's h	-1.81*	-1.74*

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations

4.3.2 Current Ratio Results

Current ratio was used as a measure of liquidity in this study as this indicates whether the co-operative is able to pay off its short term debts. The regression results of current ratio are presented in Tables 26 to 30. The double logarithmic form of the model was used; thus the coefficients on the independent variables can be interpreted as elasticities.

From the current ratio regression results presented in Tables 26 to 30, it was found that the coefficient on financial leverage of all dairy co-operatives except two were negative and significant (Table 26). One co-operative each in the grain and oilseed and livestock sub-sector had negative coefficients on financial leverage as an explanator of current ratio. This indicates that financial leverage has a negative impact on current ratio; when financial leverage increases, current ratio decreases. This is consistent with a priori expectations because it is expected that when the debts of a co-operative are high, its current ratio may be low. Comparing the magnitude of the financial leverage of the supply-managed co-operatives and the other co-operatives, it is seen that the magnitude of the coefficient on financial leverage of the supply-managed co-operatives on average is lower than that of the non-regulated co-operatives. That is, the response to financial leverage of the supply-managed co-operatives is more inelastic than for the non supply-managed co-operatives.

A positive coefficient on time trend may suggest trends in paying off debts by a co-operative over the years may not have changed. A negative coefficient on time trend may suggest that the decisions that are made by managers or management of co-operatives concerning debt payment may not be the same over some period of time.

Decisions made may change from time to time and these decisions may affect the co-operative's way of paying off their debt (i.e. its current ratio) over time. Estimated coefficients of time trend for dairy co-operatives were mostly negative; five co-operatives had negative coefficients and three had positive coefficients (Table 26). For poultry and eggs co-operatives, none had a significant coefficient on time trend as an explanation of profit margin, the same is true for grain and oilseed and livestock co-operatives. One honey and maple co-operative had a negative and significant coefficient on time trend. Two fruit and vegetable co-operatives had significant coefficients on time trend; one of these was a negative coefficient and the other was a positive coefficient.

A positive effect of firm size on current ratio implies that as the co-operative grows in size, its current ratio also increases. On the other hand, Fama and French (1993; 1995) reported a negative relationship between firm size and average returns, suggesting large firms tend to have a lower return. And lower returns may result in lower current ratio. Thus a negative relationship may exist between firm size and current ratio as is seen for some co-operatives. Firm size had positive effect on current ratio for three dairy co-operatives and a negative effect for two other dairy co-operatives. The coefficient on firm size was not significant for the poultry and egg co-operatives. Both honey and maple co-operatives had significant coefficients on firm size with one co-operative having a negative coefficient and the other having a positive coefficient. For the fruit and vegetable co-operatives, all the co-operatives had significant coefficients on firm size with one co-operative having a negative coefficient and the other two co-operatives having positive coefficients. All the grain and oilseed co-operatives had significant coefficients on firm size with one of them a having positive coefficient and the other two

having negative coefficients. Both livestock co-operatives had positive coefficients on firm size.

A negative effect of membership size on current ratio may imply that the larger the number of members in the co-operative, the less likely will the co-operative be to pay off its short term debts, perhaps because the co-operative might have diverse interests and opinions from its members. Thus, current ratio will decrease as their membership size increases. A positive relationship between membership size and current ratio may be due to increased revenue due to increase in the number of members and this may result in an ability of the co-operative to pay its short term debts. Coefficients on membership size for dairy co-operatives were found to be significant for three co-operatives with two being negative and the other being positive. One poultry and egg co-operative had a positive coefficient on membership size in explaining on current ratio; the same is true for the livestock sub-sector. One honey and maple co-operative had a negative coefficient on membership size explanation of current ratio; the same is true for the grain and oilseed sub-sector. None of the fruit and vegetable co-operatives had significant coefficients on membership size.

For the effect of input price (which is used to proxy supply management), it is seen that for the dairy co-operatives, coefficients on input price was found to be positive and significant for only two co-operatives. The magnitude of these coefficients is large which may mean that input price has an elastic effect on current ratio for those dairy co-operatives. For the poultry and eggs co-operatives, both co-operatives had significant coefficients with one co-operative having a negative coefficient and the other one having a positive coefficient. One honey and maple co-operative had a positive coefficient on

input price. One co-operative each from the fruit and vegetable and grain and oilseed sub-sectors had negative coefficient on input price as an explanator of current ratio. Overall, the results do not show a definite pattern of input price effect on current ratio: the results are inconclusive.

The effect of the current ratio in the previous year on the present year was estimated. For the dairy co-operatives, only two co-operatives had positive coefficients on the lagged dependent variable. None of the poultry and eggs co-operatives had a significant coefficient on the lagged dependent variable. None of the honey and maple co-operatives had a significant coefficient on the lagged dependent variable. Only one fruit and vegetable co-operatives had a positive coefficient on the lagged dependent variable. None of the grain and oilseed co-operatives had significant coefficients on the lagged dependent variable. One livestock co-operative had a positive coefficient on the lagged dependent variable.

The effect of the market share of individual co-operatives on their current ratio was also estimated. For the dairy co-operatives, six co-operatives had significant coefficients: five co-operatives had negative coefficients and one had a positive coefficient. One poultry and egg co-operative had a negative coefficient on its market share in explaining current ratio; the same is true for the fruit and vegetable sub-sector. One co-operative each from the grain and oilseed and livestock sub-sectors had positive coefficient on market share explanation of current ratio. A negative effect of market share on current ratio implies that as the market share of an individual co-operative increases its current ratio decreases, and vice versa. The negative effect of individual market share may be explained as that, if a co-operative has a large market share, it means that that co-

operative is a big co-operative and thus, as explained with firm size, some co-operatives tend to have lower current ratio as they become bigger. The same may be true for the reverse.

The coefficient on market concentration of dairy co-operatives was found to be significant for three co-operatives; two of these were negative and the other was positive. One poultry and egg co-operative had a negative coefficient on market concentration as an explanator of current ratio; the same is true for the honey and maple sub-sector. One livestock co-operative had a positive coefficient on market concentration. A negative coefficient on market concentration implies that as the market concentration in the sector increases, the current ratio of a co-operative in that sector decreases. This may occur if with the entry of new co-operatives into the sector, the older co-operative must meet the increased competition and holds on to capital that otherwise would have been used to pay short term debts. On the other hand, a positive effect of market concentration on current ratio may be due to more efficient allocation of resources by the individual co-operative due to increased competition and this may result in increased revenue, some of which may be used to offset the short term debts of the co-operative.

4.4 Summary of Financial Ratio Results

A financial ratio analysis was carried out for individual co-operatives in the various groups of marketing co-operatives. The results of these regressions were presented in the Tables 21 to 30. From the profit margin and current ratio results discussed above, it is seen that supply-managed co-operatives are performing comparably to the non supply-managed co-operatives. The 'elasticities' for the supply-managed co-operatives are slightly lower than non supply-managed co-operatives for profit margin

and are similar in the case of the current ratio. There seems to be little difference in the operations of co-operatives in the supply-managed and the non supply-managed sectors.

The results above are consistent with those reported by Slade (2003) who reviewed studies of the effect of market structure on profitability. Market structure does appear to have an effect on profitability and also on liquidity. The results obtained in this study are also consistent with the findings of Katz (1985) that there is a relationship between firm productivity and variables like firm size and ownership. The results are also consistent with the findings of Fama and French (1993), that firm size has an effect on financial ratios of a firm. The results of the financial ratio analysis are consistent with results of Harris and Fulton (1996). The Kruskal-Wallis results obtained are also consistent with the findings of Lerman and Parliament: the median financial ratios of co-operatives are different. The next chapter uses another method: efficiency estimation, using the profit maximization function of the co-operative to examine the performance of the co-operatives.

The use of a profit maximization function for the co-operatives is further justified by the results obtained in the financial ratio analysis. Input price which is used as a proxy for producer surplus was found not to have significant effect on profit margin or current ratio of both supply-managed and non supply-managed co-operatives. This suggests that the co-operatives are not exhibiting co-operative behaviour but are being competitive. Therefore the profit maximization function used for IOFs can be used for the co-operatives since they are being competitive.

5.0 CHAPTER FIVE: PROFIT FUNCTION AND EFFICIENCY ESTIMATION RESULTS AND DISCUSSION

5.1 Introduction

In this chapter, the data used to estimate equation 3.24 (the profit equation) and equations 3.25 to 3.27 (the input demand equations) presented in Chapter Three are presented and the results obtained from the models are discussed. The results of the firm-level system of equations and efficiency estimation are reported and discussed in this chapter. Various restrictions and tests were carried out on the system of equations and these are also discussed in the chapter.

5.2 Profit Function and Efficiency Estimation

The estimation of firm-level systems of equation of co-operatives was carried out in TSP, 4.5 version, using the least square estimation to analyze a system of equations. The system of equations estimated was the profit function and the three input demand equations. The input demand equations are derived from the profit function using Hotelling's Lemma. The input demand equations derived are for the three input variables: capital, labour and raw materials. Thus there are four equations for each individual co-operative. For the estimation the co-operatives in each sector were grouped, based on their assets and profits into large, medium and small co-operatives (see Tables 94 to 96 in the Appendix to Chapter Five). The farm level supply equation in Chapter Three (Equation 3.23) is also estimated for each sector to capture producer surplus. There is a maintained hypothesis at this point that the co-operatives in a group have the same technology but different efficiencies. The individual co-operatives in each sub-sector were grouped based on their assets and profits as large, medium and small co-operatives.

This was done to make estimation feasible as estimating all the co-operatives together was not working. Three individual co-operatives falling in the same group are estimated together; giving twelve equations in the estimation. The only exception was for the poultry and eggs co-operatives and the livestock co-operatives where only two co-operatives were estimated due to the unavailability of other co-operatives with sufficient data points.

The parameters to be estimated include ten coefficients (these are common to all three co-operatives) and twelve efficiency parameters. Non-linear multivariate regression was carried out on the equations. The hypotheses to be tested for the estimations are as follows:

Hypothesis 1:

H_0: There is equal economic efficiency (i.e. both technical and allocative efficiency) amongst the co-operatives.

H_1: There is not equal economic efficiency (i.e. both technical and allocative efficiency) amongst the co-operatives.

Hypothesis 2:

H_0: There is equal technical efficiency amongst the co-operatives.

H_1: There is not equal technical efficiency amongst the co-operatives.

Hypothesis 3:

H_0: There is equal allocative efficiency amongst the co-operatives.

H_1: There is not equal allocative efficiency amongst the co-operatives.

Hypothesis 4:

H_0: There is absolute allocative efficiency amongst the co-operatives.

H_1: There is not absolute allocative efficiency amongst the co-operatives.

To be able to test these hypotheses, various restrictions were placed on the equations. Table 61 shows the restrictions that were imposed for the various hypotheses.

Table 31: Test Of Hypotheses And The Implied Parameter Restrictions

Hypothesis	**Implied Restriction**
Equal Economic Efficiency **(EEE)**	$A^1 = A^2 = A^3$ $k_i^1 = k_i^2 = k_i^3$
Equal Technical Efficiency **(ETE)**	$A^1 = A^2 = A^3$
Equal Allocative Efficiency **(EAE)**	$k_i^1 = k_i^2 = k_i^3$
Absolute Allocative Efficiency **(AAE)**	$k_i^1 = 1, k_i^2 = 1, k_i^3 = 1$

5.2.1 The Likelihood Ratio Test

To test the hypotheses and the validity of the restrictions imposed above, a suitable test statistic has to be chosen. Examples of some test statistic that are used are the T test, the F test, the Lagrange Multiplier test, the Wald test and the Likelihood Ratio test. The Likelihood Ratio test is used in this study because it is a simple test to estimate and the results are straight forward to interpret.

Let L(UR) denote the maximum value of the likelihood function of the original unrestricted regression model. Let L(R) denote the maximum value of the model with the 'm' linear restrictions imposed on the parameters of the system to be estimated. The ratio of the two maxima is given as:

$$L^* = [L(R) / L(UR)] \quad \text{.....(5.1)}$$

As Theil (1971) shows, minus twice the logarithm of the likelihood ratio is asymptotically distributed as a Chi-Square variable with degrees of freedom (m) equal to the number of restrictions imposed. Thus:

$$-2ln\{L(R)/L(UR)\} = 2\{ln(L(UR)) - ln(L(R)\} \quad \ldots\ldots\ldots\

Table 32: Parameter Estimates of Unrestricted and Restricted Models for Medium Dairy Co-operatives [F0478 (1) F0559 (2) F1322 (3)]

Param	UR	EEE	ETE	EAE	AAE
A^1	-15.49*			-1.38	3.31***
	(9.55)			(1.74)	(0.20)
k_l^1	5.02***		0.20		
	(1.67)		(2.62)		
k_c^1	0.38***		-0.08		
	(0.06)		(3.91)		
k_r^1	-4.40***		-1.37		
	(0.73)		(1.82)		
A^2	17.26			-1.36	2.48***
	(63.66)			(1.81)	(0.12)
k_l^2	0.10***		7.13		
	(0.002)		(15.28)		
k_c^2	2.15***		1.47		
	(0.60)		(3.99)		
k_r^2	-1.25***		2.31		
	(0.39)		(3.16)		
A^3	29.06	-5.58***	-3.11	-1.37	2.76***
	(307.46)	(2.36)	(14.40)	(1.80)	(0.14)
k_l^3	2.10**	0.03	-1.37	1.58	
	(0.89)	(0.02)	(2.94)	(2.22)	
k_c^3	0.08***	67.71***	-11.92	-0.001	
	(0.002)	(20.60)	(22.31)	(0.002)	
k_r^3	-1.18***	-6.11***	0.59	0.58	
	(0.11)	(2.96)	(0.57)	(1.02)	
b_{pl}	-8.18***	2.92***	-0.69***	-3.20	-1.96**
	(1.58)	(0.16)	(0.23)	(6.07)	(0.78)
b_{pc}	0.078	47.87***	-4.86**	-0.33***	-0.29***
	(0.16)	(15.15)	(2.43)	(0.12)	(0.05)
b_{pm}	-8.26***	-5.08***	-4.68	-3.78*	-2.25**
	(1.74)	(1.53)	(2.36)	(2.22)	(1.02)
b_{plpl}	-0.42**	0.16***	-0.05	-0.03*	-2.76***
	(0.16)	(0.038)	(0.81)	(0.02)	(0.24)
b_{plpc}	-0.92***	-0.08***	-0.52**	-0.04**	-0.04***
	(0.19)	(0.02)	(0.26)	(0.02)	(0.01)
b_{plpm}	1.34***	-0.08	0.57	1.04*	2.80**
	(0.35)	(0.06)	(0.34)	(0.54)	(1.33)
b_{pcpc}	-1.29***	-0.006**	-0.62***	0.01	-0.03***
	(0.22)	(0.003)	(0.23)	(0.01)	(0.01)
b_{pcpm}	-0.37	0.074	1.14*	0.95**	0.07
	(0.41)	(0.023)	(0.69)	(0.48)	(0.05)
b_{pmpm}	-0.97	-0.006**	-1.71*	1.29*	-2.87***
	(0.76)	(0.003)	(1.01)	(0.76)	(0.98)
Time	-0.02**	-0.01**	-0.18	-0.12***	-0.16***
trend	(0.01)	(0.005)	(0.01)	(0.01)	(0.01)
LLR	-1861.13	-1872.33	-1874.72	-1874.84	-1887.82

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations.
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 33: Parameter Estimates of Unrestricted and Restricted Models for Small Dairy Co-operatives [E0296 (4) F1820 (5) E0305 (6)]

Param	UR	EEE	ETE	EAE	AAE
A^4	14.23***			-5.94	6.19
	(4.68)			(19.05)	(37.37)
k_l^4	2.05*		-0.43		
	(1.23)		(3.60)		
k_c^4	1.79**		-1.87		
	(0.87)		(11.46)		
k_r^4	2.84***		2.45		
	(1.10)		(20.83)		
A^5	-1.40			-6.05	5.76
	(1.61)			(19.41)	(34.70)
k_l^5	0.15***		-5.73		
	(0.05)		(12.94)		
k_c^5	12.48***		0.29		
	(3.02)		(6.97)		
k_r^5	16.3***		-0.08		
	(2.07)		(0.45)		
A^6	8.08***	10.88***	-23.86**	-5.94	5.71
	(3.15)	(164.91)	(12.02)	(19.07)	(34.41)
k_l^6	-1.40	-0.34	0.08	-7.64***	
	(1.61)	(0.26)	(9.24)	(2.74)	
k_c^6	2.63*	-5.31***	-0.04	-0.05**	
	(1.57)	(1.17)	(2.77)	(0.02)	
k_r^6	-0.23	6.65***	1.93	3.67	
	(2.18)	(0.43)	(9.31)	(3.09)	
b_{pl}	2.58***	1.33***	-1.68**	-2.17	-0.69**
	(0.70)	(0.18)	(0.82)	(1.84)	(0.35)
b_{pc}	-3.04***	1.19***	-3.51	-0.34**	-0.53***
	(0.28)	(0.44)	(2.89)	(0.15)	(0.12)
b_{pm}	0.46	-2.52***	-1.83**	-2.51**	-1.22**
	(0.98)	(0.62)	(0.76)	(1.26)	(0.61)
b_{plpl}	-0.34***	-0.09	-0.10	-0.37***	-0.56***
	(0.02)	(0.07)	(0.12)	(0.03)	(0.09)
b_{plpc}	-0.02***	0.14***	-0.24**	0.18***	0.005
	(0.006)	(0.04)	(0.11)	(0.03)	(0.004)
b_{plpm}	-0.32***	-0.05	0.34**	-0.55***	-0.67**
	(0.03)	(0.11)	(0.15)	(0.20)	(0.31)
b_{pcpc}	0.25***	0.05*	-0.18***	-0.22***	-0.07***
	(0.03)	(0.03)	(0.05)	(0.02)	(0.02)
b_{pcpm}	-0.27***	-0.19***	0.42*	0.40**	0.75**
	(0.05)	(0.07)	(0.24)	(0.19)	(0.30)
b_{pmpm}	-0.05**	0.24	-0.76**	-0.95***	-0.64***
	(0.02)	(0.18)	(0.30)	(0.35)	(0.22)
Time	-0.05***	-0.17***	-0.19***	-0.03***	-0.18***
	(0.001)	(0.005)	(0.02)	(0.01)	(0.01)
LLR	-1482.71	-1519.11	-1537.39	-1492.10	-1508.54

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 34: Parameter Estimates of Unrestricted and Restricted Models for Small Dairy Co-operatives [A0205(7) E0296(4) F1820(5)]

Param	UR	EEE	ETE	EAE	AAE
A^4	-280.62*			3.66	2.20***
	(160.64)			(4.89)	(0.32)
k_l^4	58.03**		-0.25		
	(23.93)		(0.52)		
k_c^4	0.79		6.71		
	(4.99)		(6.96)		
k_r^4	5.78***		15.97*		
	(1.88)		(9.45)		
A^5	-23.45			3.60	1.74***
	(16.04)			(4.84)	(0.31)
k_l^5	49.86***		-6.92***		
	(18.63)		(1.21)		
k_c^5	19.33		-2.74		
	(17.31)		(2.67)		
k_r^5	6.82***		0.44		
	(1.07)		(0.34)		
A^7	-37.28	3.62	11.64	3.53	2.73***
	(41.35)	(6.92)	(14.39)	(4.78)	(0.24)
k_l^7	0.18	-7.83	2.52	18.29**	
	(0.66)	(5.88)	(5.14)	(8.66)	
k_c^7	50.06***	-2.52	-5.92	-17.36**	
	(24.06)	(3.69)	(5.35)	(8.65)	
k_r^7	-4.92***	11.35***	5.27	7.45**	
	(2.18)	(3.36)	(6.46)	(3.23)	
b_{pl}	5.18**	2.04*	-1.42**	-1.76***	-0.69**
	(2.18)	(1.07)	(0.57)	(0.45)	(0.30)
b_{pc}	1.53*	15.47*	-0.35*	0.47***	-1.20***
	(0.83)	(8.55)	(0.18)	(0.15)	(0.09)
b_{pm}	-6.71***	-1.75**	-1.77**	-2.23*	-1.89**
	(3.01)	(0.80)	(0.69)	(1.32)	(0.86)
b_{plpl}	-0.02**	-0.04*	-0.11	-0.08	-0.39***
	(0.01)	(0.02)	(0.08)	(0.06)	(0.03)
b_{plpc}	-0.04***	0.03*	-0.08	0.04**	-0.10***
	(0.02)	(0.02)	(0.08)	(0.02)	(0.002)
b_{plpm}	-0.06	0.01	0.19*	-0.12*	0.49**
	(0.04)	(0.09)	(0.10)	(0.07)	(0.20)
b_{pcpc}	0.03***	0.01	-0.55***	-0.09***	-0.25***
	(0.02)	(0.02)	(0.18)	(0.03)	(0.02)
b_{pcpm}	0.01	-0.05	0.63**	0.13***	0.35**
	(0.05)	(0.04)	(0.25)	(0.05)	(0.15)
b_{pmpm}	-0.07**	-0.04	-0.82**	-0.25**	-0.84***
	(0.03)	(0.12)	(0.34)	(0.10)	(0.10)
Time	-0.16***	-0.33***	-0.12***	-0.18***	-0.18***
trend	(0.002)	(0.01)	(0.005)	(0.005)	(0.008)
LLR	-1432.00	-1466.80	-1476.44	-1444.46	-1452.13

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 35: Parameter Estimates of Unrestricted and Restricted Models for Large Dairy Co-operatives [F0267 (8) E0152 (9) F1399 (10)]

Param	UR	EEE	ETE	EAE	AAE
A^8	-3.96			-7.09	3.23
	(10.15)			(11.14)	(2.17)
k_l^8	9.83		10.78		
	(17.22)		(26.95)		
k_c^8	-9.72		-0.10***		
	(12.18)		(0.01)		
k_r^8	4.34**		8.04		
	(2.07)		(18.11)		
A^9	27.96			-5.38	5.47
	(293.62)			(11.03)	(3.68)
k_l^9	0.09**		-4.92		
	(0.04)		(31.28)		
k_c^9	-1.77		-2.70		
	(3.14)		(22.83)		
k_r^9	2.68*		-3.84		
	(1.56)		(28.33)		
A^{10}	5.07	-13.93	-14.60	-4.59	4.37
	(33.98)	(154.59)	(23.66)	(10.98)	(2.92)
k_l^{10}	-2.49	11.90*	-4.47	1.19	
	(4.73)	(6.33)	(3.74)	(11.50)	
k_c^{10}	0.11***	-24.49**	0.34	-3.53	
	(0.04)	(11.72)	(0.73)	(2.50)	
k_r^{10}	3.38	13.59*	-2.69	1.05	
	(2.49)	(7.99)	(2.78)	(3.41)	
b_{pl}	0.69***	0.61**	-0.67**	-0.79**	-1.23**
	(0.24)	(0.28)	(0.32)	(0.35)	(0.60)
b_{pc}	-1.37	0.12	-3.75	-0.10	-0.48***
	(2.86)	(0.26)	(2.42)	(3.57)	(0.05)
b_{pm}	0.68	-0.73	-0.70***	-0.45**	-0.58*
	(1.97)	(1.09)	(0.20)	(0.24)	(0.30)
b_{plpl}	-0.22	0.15*	-0.58	-0.04	-0.42***
	(0.32)	(0.46)	(0.51)	(0.29)	(0.13)
b_{plpc}	-0.28**	0.01	-0.28*	-0.04***	0.12***
	(0.13)	(0.009)	(0.17)	(0.01)	(0.003)
b_{plpm}	-0.5	0.16**	0.86**	-0.17*	-0.54**
	(0.45)	(0.08)	(0.40)	(0.08)	(0.25)
b_{pcpc}	0.47**	0.05***	-0.31	-0.05***	-0.02***
	(0.22)	(0.01)	(0.20)	(0.01)	(0.005)
b_{pcpm}	-0.19	-0.06	-0.59**	0.09**	-0.37**
	(0.15)	(0.04)	(0.28)	(0.03)	(0.14)
b_{pmpm}	-0.31**	-0.22	-1.45*	-0.28**	-0.62***
	(0.80)	(0.16)	(0.78)	(0.15)	(0.10)
Time trend	-0.19***	-0.18***	0.18***	-0.17***	-0.22***
	(0.02)	(0.01)	(0.002)	(0.006)	(0.001)
LLR	-2187.44	-2178.17	-2182.45	-2187.87	-2137.43

Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 36: Parameter Estimates of Unrestricted and Restricted Models for Poultry and Eggs Co-operatives [B0264(11) D0147 (12)]

Param	UR	EEE	ETE	EAE	AAE
A^{11}	-2.87			9.41	12.91***
	(4.63)			(7.99)	(1.38)
k_l^{11}	7.23**		1.11		
	(3.56)		(1.16)		
k_c^{11}	0.12**		0.14		
	(0.05)		(0.48)		
k_r^{11}	-6.35*		0.68		
	(3.67)		(0.59)		
A^{12}	3.72	-2.92	-8.49	10.21	12.40***
	(13.64)	(38.12)	(15.77)	(7.89)	(1.08)
k_l^{12}	4.67**	9.15***	1.60	-0.32	
	(2.27)	(3.08)	(1.81)	(4.44)	
k_c^{12}	0.28*	0.18**	0.21**	1.34	
	(0.15)	(0.12)	(0.08)	(4.42)	
k_r^{12}	3.95*	8.33*	1.42	1.02	
	(2.09)	(2.2)	(1.05)	(1.10)	
b_{pl}	-1.64***	-2.15***	-0.22	-4.41*	-0.69**
	(0.62)	(0.71)	(1.07)	(2.25)	(0.31)
b_{pc}	-0.34***	-0.34***	-0.35**	-0.38**	0.16
	(0.10)	(0.10)	(0.15)	(0.16)	(0.12)
b_{pm}	-1.98	-2.45**	-0.11	-1.04*	-0.36**
	(1.68)	(1.15)	(0.10)	(0.56)	(0.16)
b_{plpl}	-0.28***	-0.18***	-0.29***	-0.08	-0.24***
	(0.05)	(0.04)	(0.07)	(0.05)	(0.05)
b_{plpc}	0.07	0.04***	0.02	0.04***	-0.20***
	(0.05)	(0.01)	(0.06)	(0.01)	(0.003)
b_{plpm}	0.21	0.18*	0.13**	0.12	0.05*
	(0.36)	(0.10)	(0.06)	(0.10)	(0.03)
b_{pcpc}	-0.03**	0.01	-0.04**	-0.02*	-0.05**
	(0.04)	(0.007)	(0.02)	(0.01)	(0.02)
b_{pcpm}	-0.11	-0.05	0.26**	0.24**	0.13
	(0.13)	(0.04)	(0.12)	(0.11)	(0.14)
b_{pmpm}	-0.10*	-0.09*	-0.43**	-0.15**	-0.19*
	(0.06)	(0.05)	(0.21)	(0.07)	(0.11)
Time	-0.02***	-0.10***	-0.01	-0.14***	-0.18***
trend	(0.008)	(0.01)	(0.02)	(0.03)	(0.06)
LLR	-1408.47	-1413.26	-1447.22	-1427.13	-1452.13

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 37: Parameter Estimates of Unrestricted and Restricted Models for Fruits and Vegetables Co-operatives [A0066 (13) A0099 (14) E0333 (15)]

Param	UR	EEE	ETE	EAE	AAE
A^{13}	31.26***			1.39	33.76***
	(9.26)			(10.42)	(2.26)
k_l^{13}	-2.18***		1.54***		
	(0.71)		(0.29)		
k_c^{13}	0.47***		-0.28		
	(0.20)		(1.33)		
k_r^{13}	2.71		1.04**		
	(1.98)		(0.54)		
A^{14}	10.02			1.39	17.82***
	(105.39)			(10.40)	(1.17)
k_l^{14}	0.23***		-9.29***		
	(0.07)		(3.33)		
k_c^{14}	-1.61**		-4.59***		
	(0.67)		(1.30)		
k_r^{14}	2.38		-2.76***		
	(2.31)		(0.78)		
A^{15}	18.73***	8.50	-3.45***	1.38	21.73***
	(6.17)	(10.27)	(0.42)	(10.38)	(1.35)
k_l^{15}	-5.49	0.03***	2.93**	-4.30	
	(5.55)	(0.001)	(1.24)	(3.40)	
k_c^{15}	2.37	2.06	-3.06***	-3.27	
	(4.79)	(3.70)	(0.40)	(2.67)	
k_r^{15}	4.12**	-0.03	1.39	-0.003	
	(1.89)	(10.34)	(1.15)	(0.002)	
b_{pl}	-0.61***	-2.07*	-0.70**	-2.24	-1.38***
	(0.15)	(1.14)	(0.34)	(1.82)	(0.09)
b_{pc}	-1.39***	-0.34**	-1.75***	-0.33**	-0.34**
	(0.39)	(0.15)	(0.16)	(0.16)	(0.12)
b_{pm}	-2.05*	-2.41**	-0.95*	-0.45**	-0.60**
	(1.23)	(1.22)	(0.41)	(0.22)	(0.30)
b_{plpl}	-0.32*	-0.12***	-0.12***	-1.16***	-0.05***
	(0.18)	(0.05)	(0.002)	(0.12)	(0.008)
b_{plpc}	-0.38***	-0.21***	-0.24***	-0.34***	-0.24***
	(0.09)	(0.06)	(0.02)	(0.09)	(0.02)
b_{plpm}	0.70	0.09**	-0.10**	0.06**	-0.15*
	(0.36)	(0.04)	(0.05)	(0.03)	(0.08)
b_{pcpc}	-0.47***	0.17***	-0.20***	-1.52***	-0.06***
	(0.17)	(0.06)	(0.02)	(0.07)	(0.01)
b_{pcpm}	0.85*	-0.38	0.45	0.57**	0.42**
	(0.45)	(0.20)	(0.36)	(0.20)	(0.20)
b_{pmpm}	-1.55**	-0.47***	-0.16*	-0.89**	-0.81**
	(0.78)	(0.13)	(0.10)	(0.36)	(0.39)
Time trend	-0.13***	-0.15***	0.38***	-0.07***	0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.002)
LLR	-1941.70	-1950.03	-1957.00	-1964.14	-1973.12

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 38: Parameter Estimates of Unrestricted and Restricted Models for Honey and Maple Co-operatives [B0085 (16) D0145 (17)]

Param	UR	EEE	ETE	EAE	AAE
A^{11}	-2.34			4.76	3.56
	(3.90)			(3.90)	(4.32)
k_l^{11}	6.82**		1.38		
	(3.42)		(1.90)		
k_c^{11}	0.45		0.76		
	(0.90)		(0.90)		
k_r^{11}	-2.32*		0.47		
	(1.41)		(0.54)		
A^{12}	1.01	-1.08	-3.43	4.65	3.45**
	(5.76)	(4.90)	(9.51)	(5.09)	(1.46)
k_l^{12}	2.78**	4.12**	1.65	-0.52	
	(1.36)	(1.68)	(1.28)	(2.65)	
k_c^{12}	0.28	0.32**	0.43**	1.36	
	(0.76)	(0.16)	(0.21)	(2.74)	
k_r^{12}	1.04*	2.21*	1.84	1.59	
	(0.63)	(1.30)	(1.69)	(1.98)	
b_{pl}	-2.07***	-1.56***	-0.87	-2.31*	-0.78**
	(0.78)	(0.58)	(1.34)	(1.25)	(0.39)
b_{pc}	-0.12***	-0.98**	-0.78***	-0.34**	0.45*
	(0.04)	(0.47)	(0.27)	(0.17)	(0.25)
b_{pm}	-1.98	-1.57**	-0.89	-1.26*	-0.63
	(1.68)	(0.78)	(1.03)	(0.68)	(0.78)
b_{plpl}	-0.28	-0.38**	-0.69**	-0.17	-0.67**
	(0.79)	(0.19)	(0.33)	(0.20)	(0.27)
b_{plpc}	0.18	0.13**	0.04	0.12***	-0.95**
	(0.50)	(0.07)	(0.05)	(0.05)	(0.40)
b_{plpm}	0.90	0.21*	0.54**	0.36	0.51*
	(0.86)	(0.12)	(0.23)	(0.89)	(0.27)
b_{pcpc}	-0.03*	0.23	-0.06**	-0.48**	-0.40**
	(0.02)	(0.25)	(0.03)	(0.21)	(0.17)
b_{pcpm}	-0.86	-0.80	0.62**	0.69**	0.34**
	(0.81)	(0.86)	(0.23)	(0.35)	(0.13)
b_{pmpm}	-0.45*	-0.09*	-0.29**	-0.34*	-0.57
	(0.26)	(0.05)	(0.14)	(0.18)	(0.63)
Time	-0.01***	-0.12***	-0.10***	-0.09***	-0.16***
trend	(0.003)	(0.03)	(0.03)	(0.03)	(0.04)
LLR	-1452.41	-1461.78	-1468.30	-1479.85	-1495.20

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 39: Parameter Estimates of Unrestricted and Restricted Models for Grains and Oilseeds Co-operatives [E0192 (18) C0001 (19) E0234 (20)]

Param	UR	EEE	ETE	EAE	AAE
A^{16}	-18.66			-2.12*	13.33***
	(26.13)			(1.24)	(2.21)
k_l^{16}	2.16***		8.95***		
	(0.70)		(2.66)		
k_c^{16}	-0.24***		0.05***		
	(0.06)		(0.01)		
k_r^{16}	-0.92		6.78***		
	(1.05)		(2.67)		
A^{17}	-8.82			-2.29	11.17***
	(17.72)			(8.15)	(1.93)
k_l^{17}	14.27***		-0.03		
	(2.97)		(2.40)		
k_c^{17}	-10.23***		0.02		
	(0.20)		(0.75)		
k_r^{17}	3.04		0.46*		
	(2.68)		(0.27)		
A^{18}	24.30	4.27***	4.75	-1.98	9.12***
	(536.44)	(0.99)	(1.54)	(5.59)	(1.23)
k_l^{18}	8.66***	-0.03***	-11.58***	0.42	
	(1.06)	(0.001)	(2.57)	(39.96)	
k_c^{18}	-6.67***	-8.32***	-19.68*	-0.04	
	(0.29)	(1.93)	(11.25)	(2.00)	
k_r^{18}	-0.99	9.35*	5.78***	-0.19	
	(1.20)	(5.18)	(2.04)	(0.16)	
b_{pl}	-0.51***	-3.56***	-0.69**	-0.62**	-0.41
	(0.13)	(0.52)	(0.35)	(0.31)	(0.26)
b_{pc}	-3.31**	-0.34**	-0.16	-0.33***	-0.43**
	(1.43)	(0.14)	(0.12)	(0.12)	(0.21)
b_{pm}	-3.82*	-3.90*	-0.38*	-0.59	-0.23*
	(1.78)	(2.31)	(0.23)	(0.47)	(0.13)
b_{plpl}	-0.58***	-0.87***	-0.05***	-0.02	-0.22***
	(0.08)	(0.18)	(0.006)	(0.11)	(0.08)
b_{plpc}	-1.14***	0.01***	0.007	-0.02*	0.08***
	(0.17)	(0.01)	(0.006)	(0.009)	(0.003)
b_{plpm}	1.72*	0.86	0.65***	0.74***	-0.65***
	(1.04)	(0.65)	(0.27)	(0.30)	(0.13)
b_{pcpc}	0.72***	-0.02***	-0.04***	-0.02***	-0.05***
	(0.19)	(0.001)	(0.01)	(0.01)	(0.002)
b_{pcpm}	0.42	0.10**	0.47*	0.63**	-0.45
	(0.30)	(0.05)	(0.28)	(0.31)	(0.34)
b_{pmpm}	-2.14**	-0.87**	-0.82*	-0.91**	-0.75**
	(1.08)	(0.35)	(0.49)	(0.42)	(0.32)
Time	-0.10***	-0.16***	0.07***	-0.11***	-0.08***
trend	(0.01)	(0.01)	(0.005)	(0.01)	(0.002)
LLR	-1909.86	-1891.37	-1921.71	-1918.43	-1919.22

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

Table 40: Parameter Estimates of Unrestricted and Restricted Models for Livestock Co-operatives [A0197 (21) B0358 (22)]

Param	UR	EEE	ETE	EAE	AAE
A^{19}	-4.09			-2.35	-4.37*
	(70.83)			(5.44)	(2.46)
k_l^{19}	1.58		0.38*		
	(2.13)		(0.22)		
k_c^{19}	-0.98		-11.91***		
	(2.18)		(2.57)		
k_r^{19}	0.40		-3.58		
	(1.26)		(2.79)		
A^{20}	-21.08***	-3.21***	-5.54	-2.44	4.37**
	(5.58)	(0.32)	(8.72)	(5.65)	(1.82)
k_l^{20}	-0.77	0.06	1.00***	-17.19	
	(0.55)	(1.49)	(0.18)	(11.06)	
k_c^{20}	0.55*	-6.12***	-0.005	18.03*	
	(0.32)	(1.99)	(0.38)	(10.95)	
k_r^{20}	1.22*	0.03*	-0.54*	-2.84	
	(0.69)	(0.30)	(0.32)	(4.88)	
b_{pl}	-18.23***	-2.15***	-1.31**	-3.94**	-3.73***
	(8.24)	(0.71)	(0.57)	(1.96)	(0.56)
b_{pc}	-0.53***	-8.49***	-0.44**	-2.45***	-0.45**
	(0.12)	(1.33)	(0.21)	(0.49)	(0.21)
b_{pm}	-1.86	-32.05**	-1.24*	-2.09**	-1.79*
	(1.68)	(7.43)	(0.75)	(1.01)	(0.90)
b_{plpl}	-3.53***	-3.26***	-0.32**	-0.17	-0.76***
	(1.36)	(0.61)	(0.16)	(0.13)	(0.09)
b_{plpc}	0.14**	-1.16***	-0.37**	0.12*	-0.03
	(0.06)	(0.21)	(0.16)	(0.06)	(0.03)
b_{plpm}	3.39	2.54*	-1.50*	-2.41**	-0.99**
	(2.86)	(1.41)	(0.92)	(1.06)	(0.41)
b_{pcpc}	-0.03	-0.61**	-0.80***	-0.07*	-0.17***
	(0.04)	(0.31)	(0.27)	(0.04)	(0.02)
b_{pcpm}	-0.12	1.77**	-0.43**	-0.64	0.69*
	(0.13)	(0.89)	(0.20)	(0.56)	(0.41)
b_{pmpm}	-3.28**	-4.46*	-2.26***	-1.97*	-1.90**
	(1.29)	(2.35)	(0.14)	(1.10)	(0.80)
Time trend	-0.02**	0.69***	0.09***	0.02	0.08***
	(0.01)	(0.15)	(0.007)	(0.01)	(0.007)
LLR	-904.76	-914.34	-910.53	-912.55	-919.28

Note: ***, **, * *denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations
k_l = allocative efficiency of labour, k_c = allocative efficiency of capital, k_r = allocative efficiency of raw material.

For the medium size dairy co-operatives, it is found that none of the three co-operatives were technically efficient. They were labour and capital efficient with inefficient raw material use. Looking at the efficiency terms for the small dairy co-operatives in Tables 33 and 34, only two co-operatives had significant coefficients on the technical efficiency variable. With the exception of one co-operative, the small dairy co-operatives were found to have significant coefficients on the allocative efficiency term. The large dairy co-operatives were found to be technically and allocatively inefficient.

For the poultry and eggs co-operatives, there were insignificant coefficients on the technical efficiency term. These were, however, labour and capital efficient with one of them being inefficient with raw material use. Two fruits and vegetable co-operatives were technically efficient, but on the whole, the fruits and vegetables co-operatives were allocatively inefficient. For the honey and maple co-operatives, both co-operatives were found to be technically inefficient. The honey and maple co-operatives were labour and raw material efficient but inefficient with respect to capital use. All the grain and oilseed co-operatives were technically inefficient but labour efficient. The livestock co-operatives were found to be neither technically nor allocatively efficient. For the restricted model, similar results were obtained: the constrained technical efficiencies were all found to be insignificant with the exception of grain and oilseed co-operatives for which it was positive and significant.

The results of the efficiency terms suggest that both supply-managed and non supply-managed co-operatives are relatively technically inefficient. However, comparing allocative efficiency of the supply-managed co-operatives with the non supply-managed co-operatives, small dairy co-operatives and large poultry and eggs co-operatives are

allocatively efficient. The results indicate that supply-managed co-operatives and the non supply-managed co-operatives have insignificant coefficients on their efficiency terms; they are not efficient. It may be concluded that supply management may not increase or improve the efficiency of co-operatives. Both supply-managed co-operatives and the non supply-managed co-operatives are not maximizing profits. This finding is consistent with the conclusion of Porter and Scully (1987). In their study on the economic efficiency in co-operatives, Porter and Scully (1987) compared the economic efficiency of co-operatives with that of non co-operatives. Their results showed that non co-operatives were about 30% more economically efficient than co-operatives. What are some of the possible causes of these inefficiencies? These may potentially be explained by the existence of X-inefficiency, which in turn may be the result of bad management practices and distorted motivations (i.e. the principal-agent dilemma). Porter and Scully (1987) concluded from their studies that the source of co-operative inefficiency is not allocative inefficiencies, argued in literature to arise from the pursuit of alternative objective functions, but is caused by inherent weakeness in the structure of property rights within co-operatives.

Using these results to address the second objective of this study, the implications of both supply-managed co-operatives and the non supply-managed co-operatives not maximizing profits for producers are that producers may not be attaining the benefits that should occur when there is efficiency in the sectors. This occurs since the co-operatives are not technically efficient they will not have succeeded in maximizing returns which they would have given back to producers as patronage payments. Consumers may also be affected by inefficiency costs being transferred to them in the form of higher prices. The

issue of inefficiencies in the regulated sectors and the non-regulated sectors therefore needs to be addressed for the benefit of producers and consumers alike.

5.3 Results of Hypothesis Testing

Four different restrictions were imposed on the unrestricted models to ascertain whether the individual co-operatives in the group had equal efficiency. The restrictions imposed were equal economic efficiency, equal technical efficiency, equal allocative efficiency and absolute allocative efficiency. The likelihood ratio test was used for testing the imposed restrictions. The results outlined in Tables 41 to 49.

Table 41: Hypothesis Testing Results Medium Dairy Co-operatives [F0478 (1) F0559 (2) F1322 (3)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1861.13				
EEE	4	-1872.33	22.40	9.49	13.28	Reject H_0
ETE	1	-1874.72	27.18	3.84	6.64	Reject H_0
EAE	3	-1874.84	27.42	7.82	11.35	Reject H_0
AAE	3	-1887.82	25.96	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 42: Hypothesis Testing Results Small Dairy Co-operatives [E0296 (4) F1820 (5) E0305 (6)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1482.71				
EEE	4	-1519.11	72.80	9.49	13.28	Reject H_0
ETE	1	-1537.39	109.36	3.84	6.64	Reject H_0
EAE	3	-1492.10	18.78	7.82	11.35	Reject H_0
AAE	3	-1508.54	32.88	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 43: Hypothesis Testing Results Small Dairy Co-operatives [A0205(7) E0296(4) F1820(5)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1432.00				
EEE	4	-1466.80	69.60	9.49	13.28	Reject H_0
ETE	1	-1476.44	88.88	3.84	6.64	Reject H_0
EAE	3	-1444.46	24.92	7.82	11.35	Reject H_0
AAE	3	-1452.13	15.34	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 44: Hypothesis Testing Results Large Dairy Co-operatives [F0267 (8) E0152 (9) F1399 (10)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-2187.44				
EEE	4	-2178.17	-18.54	9.49	13.28	Maintain H_0
ETE	1	-2182.45	-9.98	3.84	6.64	Maintain H_0
EAE	3	-2187.87	0.86	7.82	11.35	Maintain H_0
AAE	3	-2197.43	19.12	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 45: Hypothesis Testing Results for Poultry and Eggs Co-operatives [B0264(11) D0147 (12)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1408.47				
EEE	4	-1413.26	9.58	9.49	13.28	Reject at 5%
ETE	1	-1447.22	77.50	3.84	6.64	Reject H_0
EAE	3	-1427.13	37.32	7.82	11.35	Reject H_0
AAE	3	-1452.13	50.00	7.82	11.35	Reject H_0

Table 46: Hypothesis Testing Results for Fruits and Vegetables Co-operatives [A0066 (13) A0099 (14) E0333 (15)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1941.70				
EEE	4	-1950.03	16.66	9.49	13.28	Reject H_0
ETE	1	-1957.00	30.60	3.84	6.64	Reject H_0
EAE	3	-1964.14	44.88	7.82	11.35	Reject H_0
AAE	3	-1973.12	17.96	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 47: Hypothesis Testing Results for Honey and Maple Co-operatives [B0085 (16) D0145 (17)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1452.41				
EEE	4	-1461.78	18.74	9.49	13.28	Reject H_0
ETE	1	-1468.30	31.78	3.84	6.64	Reject H_0
EAE	3	-1479.85	54.88	7.82	11.35	Reject H_0
AAE	3	-1495.20	30.70	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 48: Hypothesis Testing Results for Grains and Oilseeds Co-operatives [E0192 (18) C0001 (19) E0234 (20)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-1909.86				
EEE	4	-1891.37	-36.98	9.49	13.28	Maintain H_0
ETE	1	-1921.71	23.70	3.84	6.64	Reject H_0
EAE	3	-1918.43	17.14	7.82	11.35	Reject H_0
AAE	3	-1919.22	1.58	7.82	11.35	Maintain H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

Table 49: Hypothesis Testing Results for Livestock Co-operatives [A0197 (21) B0358 (22)]

Hypothesis	Restriction	Log. Likelihood	X^2			Decision
			Cal.	Critical		
				5%	1%	
UR		-904.76				
EEE	4	-914.34	19.178	9.49	13.28	Reject H_0
ETE	1	-910.53	11.54	3.84	6.64	Reject H_0
EAE	3	-912.55	15.58	7.82	11.35	Reject H_0
AAE	3	-919.28	29.04	7.82	11.35	Reject H_0

Note: Cal. = the calculated H statistics
Critical = the critical values from the chi-square distribution table

The results obtained from the tests in Tables 41 to 49 showed that on the whole, the hypothesis that there is equal economic efficiency among the individual co-operatives is rejected. This implies that the co-operatives do not have equal economic efficiency; each co-operative has its own level of efficiency. This result also suggests that the co-operatives may be operating with different kinds of technologies within the same sector and across various sectors. Looking at the large dairy co-operatives and the grains and oilseeds co-operatives, it is seen that the null hypothesis was not rejected. This may be explained by the fact that, in these two groups, equal economic efficiency was found to be not statistically significant from zero. This means that all the co-operatives in these groups have the same levels of economic efficiency. The hypothesis that there is equal technical efficiency among co-operatives in a group was also rejected for all the groups except the group of large dairy co-operatives. This indicates that the technical efficiency for the individual co-operatives in that group is different. Equal and absolute allocative efficiency were also tested and the results showed that the hypothesis of equal or absolute efficiency is rejected for the various sectors. This means that that the allocative efficiency of the co-operatives is not equal and neither are they absolute.

5.4 Estimates of Price Elasticities of Input Demand

For each group of co-operatives, the price elasticities of the input demands were estimated using the parameter estimates obtained from the unrestricted models estimated for each group. The algebraic form of each of these elasticities is presented in the Appendix. The elasticity estimates obtained are presented in Tables 97 to 105 in the Appendix to Chapter Five.

The elasticity estimates obtained show how the demand for an input will change with a change in own price or the price of other inputs. Looking at the elasticity estimates, it is observed that these are quite elastic. This suggests that a small change in the price of an input results in a large change in the quantity demanded of that input or another input. On the whole, the price elasticities were found to be elastic, with some being more elastic than others. The cross price elasticities were found to be inconsistent. For the elasticities of medium size dairy co-operatives, it is seen that the own price elasticities of labour, capital and raw materials were all negative and significant as expected. The own price elasticity of raw materials was the most elastic, indicating an increase in the price of raw materials by 1% will cause a decrease in the quantity demanded of raw material by 3.16% in this group of dairy co-operatives (Table 97). This may be explained as the co-operatives demanding less input when the input price goes up because when input price increases, their cost of producing output will increase and their profits will decrease. Labour and capital are found to be substitutes within this group of co-operatives. The quantity demanded of raw materials was found to be very responsive to price changes in all inputs. For large dairy co-operatives, the own price elasticities for all three inputs were negative. The quantity of labour demanded was found to be the most

responsive to changes in the price of all inputs. In the group of large size dairy co-operatives, raw material and capital were found to be substitutes (Table 98). It may be that as the price of capital increases, the demand for capital will decrease, so more raw materials will be needed to produce more output to generate returns to capital. For small size dairy co-operatives, own price elasticities were negative for labour and capital but not for raw materials. Raw materials and capital were found to be substitutes in this group. For the poultry and egg co-operatives, the own price elasticities were found to be negative as expected. The quantity of labour demanded was very responsive to price changes in all the inputs. Fruit and vegetable co-operatives also had negative own price elasticities. Labour and capital were found to be substitutes. This implies that an increase in the price of labour leads to an increase in the price of capital and vice versa (Table 102). For the honey and maple co-operatives (Table 103), the co-operatives had negative and significant own price elasticities for labour and raw materials but not for capital. Quantity demanded of raw materials was found to be very responsive to price changes in all the inputs. For grain and oilseed co-operatives, capital and labour were found to be complements. Quantity demanded for inputs were very responsive to price changes in this sector. For livestock co-operatives, the price of labour had negative effects on the quantity demanded of all the inputs.

In summary, it is seen that the demand for all the inputs in all the various sub-sectors are very responsive to price changes in input markets, with labour being the most responsive. Even slight changes in the price of labour will cause more than proportional change in the quantity of labour demanded. This is also true for capital and raw materials.

5.5 Estimated Effects Of Potential Efficiency Improvements

The profit and efficiency estimates obtained in Tables 32 to 40, as well as farm supply equation and identities for producer surplus were applied to simulate predictions of the effects on profit, producer surplus, member welfare and the quantity of inputs used by the various sub-sectors. Using equation 3.23, i.e. the farm level supply equation, an identity was specified which calculates the amount of input used by the various sub-sectors and their producer surplus estimates. Four different simulations were carried out for each sub-sector; the unrestricted model, the restricted model imposing equal economic efficiency, the restricted model imposing equal technical efficiency and the restricted model imposing absolute allocative efficiency. The farm supply equation that was estimated in the simulation regression is specified for the supply-managed and non supply-managed sub-sectors. The farm supply (FS) is given by

$FS = Q_{coop} + EXOG_Q$ .....(5.3)

Where

Q_{coop} = Quantity of input supplied to co-operatives in a sub-sector

$EXOG_Q$ = Exogenous quantity of input used in that sub-sector

But

$FS = c + d*MCP$ .....(5.4)

Where

MCP = Marginal Cost Price for producers

c, d are parameters to be estimated.

$MCP = FP$ .....(5.5)

FP = Producer price paid to producers or farm price

The producer surplus identity was then obtained from the farm supply equation. A detailed derivation of the producer surplus equation is found in the Appendix to Chapter Five. The parameters *a* and *b* estimated in equation 5.4 are used in the producer surplus identity given as:

$$PS = -\left(\frac{3c^2}{4d}\right) - \frac{c}{2d}\beta_1(k_1 * PL/A) - \frac{c}{2d}\beta_2(k_2 * PC/A) - \frac{c}{2d}\beta_3(k_3 * PR/A)$$
$$+ \frac{3}{4d} * \frac{1}{2}\beta_{11}(k_1 * PL/A)^2 + \frac{3}{4d} * \frac{1}{2}\beta_{22}(k_2 * PC/A)^2 + \frac{3}{4d} * \frac{1}{2}\beta_{33}(k_3 * PR/A)^2$$
$$+ \frac{3}{4d}\beta_{12}(k_1 * PL/A) * (k_2 * PC/A) + \frac{3}{4d}\beta_{13}(k_1 * PL/A) * (k_3 * PR/A)$$
$$+ \frac{3}{4d}\beta_{23}(k_2 * PC/A) * (k_3 * PR/A)$$

(5.7)

The producer surplus identity specified above is the total producer surplus for all the members in a co-operative. To obtain the producer surplus of one member of the co-operative, the total producer surplus will have to be divided by the total number of members in that co-operative, i.e.

PS of one member = PS / Total number of members.

The simulation model estimated comprised the profit and input demand equations in equations 3.24, 3.25 – 3.27 in Chapter Three, the farm supply equation 5.3 (the results of the farm level supply equations of the various sub-sectors are presented in Table 106 in the Appendix to Chapter Five) and the producer surplus equation in equation 5.7. The systems of equation estimated in the simulation model for the supply-managed co-operatives are given as:

The profit equation:

$$
\begin{aligned}
ln\pi &= ln(A) + \beta_0 + \beta_1[lnk_1 + lnPL - lnA] + \beta_2[lnk_2 + lnPC - lnA] + \beta_3[lnk_3 + lnPR - lnA] \\
&+ \frac{1}{2}[\beta_{11}(lnk_1 + lnPL - lnA)*(lnk_1 + lnPL - lnA)] + \frac{1}{2}[\beta_{12}(lnk_1 + lnPL - lnA)*(lnk_2 + lnPC - lnA)] \\
&+ \frac{1}{2}[\beta_{13}(lnk_1 + lnPL - lnA)*(lnk_3 + lnPR - lnA)] + \frac{1}{2}[\beta_{21}(lnk_2 + lnPC - lnA)*(lnk_1 + lnPL - lnA)] \\
&+ \frac{1}{2}[\beta_{22}(lnk_2 + lnPC - lnA)*(lnk_2 + lnPC - lnA)] + \frac{1}{2}[\beta_{23}(lnk_2 + lnPC - lnA)*(lnk_3 + lnPR - lnA)] \\
&+ \frac{1}{2}[\beta_{31}(lnk_3 + lnPR - lnA)*(lnk_1 + lnPL - lnA)] + \frac{1}{2}[\beta_{32}(lnk_3 + lnPR - lnA)*(lnk_2 + lnPC - lnA)] \\
&+ \frac{1}{2}[\beta_{33}(lnk_3 + lnPR - lnA)*(lnk_3 + lnPR - lnA)] \\
&- ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right] * \left[\begin{matrix}\beta_{11}(lnk_1 + lnPL - lnA) + \beta_{22}(lnk_2 + lnPC - lnA) \\ + \beta_{33}(lnk_3 + lnPR - lnA)\end{matrix}\right]
\end{aligned}
$$

(5.8)

Share Equation for Labour

$$
\begin{aligned}
Q_L &= \beta_1 + \beta_{11}(lnk_1 - lnA + lnPL) + \beta_{12}(lnk_2 - lnA + lnPC) + \beta_{13}(lnk_3 - lnA + lnPR) \\
&- \beta_{11} * ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]
\end{aligned}
$$

(5.9)

Share Equation for Capital

$$
\begin{aligned}
Q_C &= \beta_2 + \beta_{22}(lnk_2 - lnA + lnPC) + \beta_{12}(lnk_1 - lnA + lnPL) + \beta_{23}(lnk_3 - lnA + lnPR) \\
&- \beta_{22} * ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]
\end{aligned}
$$

(5.10)

Share Equation for Raw Material

$$Q_R = \beta_3 + \beta_{33}(Ink_3 - InA + InPR) + \beta_{13}(Ink_1 - InA + InPL) + \beta_{23}(Ink_2 - InA + InPC)$$
$$- \beta_{33} * In\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]$$

(5.11)

where

π = normalized profit (ie profit divided by price of output)

PL = normalized price of labour

PR = normalized price of raw material

PC = normalized price of capital

k = allocative efficiency term

A = technical efficiency term

Q_L = quantity of labour demanded

Q_C = quantity of capital demanded

Q_R = quantity of raw material or input demanded

The Farm Supply Equation

$$FS = Q_R + EXOG_Q \quad \text{.....(5.12)}$$

$$FS = \beta_0 + \beta_1 * TT + \beta_2 * FS(-1) + \beta_3 * MCP \quad \text{.....(5.13)}$$

where

FS = Farm supply

TT = Time trend

$FS(-1)$ = Lagged dependent variable

MCP = Marginal Cost Price for producers

Under general market conditions,

$MCP = FP$

where

FP = Farm price

However, for the supply-managed sub-sectors, the farm price is the marginal cost price plus quota value, i.e.

$FP = MCP + QV$ .....(5.14)

QV = Quota value of producing the input

Therfore

$MCP = FP - QV$ .....(5.15)

Equation 5.13 becomes

$$FS = \beta_0 + \beta_1 * TT + \beta_2 * FS(-1) + \beta_3 * (FP - QV) \quad \text{.....(5.16)}$$

The Producer Surplus Identity

$$PS = -\left(\frac{3c^2}{4d}\right) - \frac{c}{2d}\beta_1(k_1 * PL/A) - \frac{c}{2d}\beta_2(k_2 * PC/A) - \frac{c}{2d}\beta_3(k_3 * PR/A)$$
$$+ \frac{3}{4d} * \frac{1}{2}\beta_{11}(k_1 * PL/A)^2 + \frac{3}{4d} * \frac{1}{2}\beta_{22}(k_2 * PC/A)^2 + \frac{3}{4d} * \frac{1}{2}\beta_{33}(k_3 * PR/A)^2$$
$$+ \frac{3}{4d}\beta_{12}(k_1 * PL/A) * (k_2 * PC/A) + \frac{3}{4d}\beta_{13}(k_1 * PL/A) * (k_3 * PR/A)$$
$$+ \frac{3}{4d}\beta_{23}(k_2 * PC/A) * (k_3 * PR/A) \quad \text{(5.17)}$$

Thus the simulation model estimated for the supply-managed sub-sectors are equations 5.8, 5.9, 5.10, 5.11, 5.12, 5.16 and 5.17. The endogenous variables in the estimation are; normalized profit, quantity of labour, quantity of capital, quantity of raw material, farm supply, farm price and quota value.

The systems of equation estimated in the simulation model for the non supply-managed co-operatives are the same as that of the supply-managed co-operatives; the only difference is in their farm supply equation. For the non-supply managed co-operatives, marginal cost price is equated to the farm price, i.e.

$$MCP = FP \quad \text{.....(5.18)}$$

Substituting equation 5.18 into 5.13, the farm supply equation of non supply-managed co-operatives becomes;

$$FS = \beta_0 + \beta_1 * TT + \beta_2 * FS(-1) + \beta_3 * FP \quad \text{.....(5.19)}$$

Thus the simulation model estimated for the supply-managed sub-sectors are equations 5.8, 5.9, 5.10, 5.11, 5.12, 5.17 and 5.19. The endogenous variables in the estimation are; normalized profit, quantity of labour, quantity of capital, quantity of raw material, farm supply, and farm price. The simulation models estimated for the supply-managed and non supply-managed sub-sectors are summarized in Table 50.

The results of the simulations carried out on the various sub-sectors are reported in Tables 51 to 52.

Table 50: Simulation Model For Supply-Managed And Non Supply-Managed Sub-Sectors

Simulation Model For Supply-Managed And Non Supply-Managed Sub-Sectors	
Equations	**Endogenous Variables**
Profit Equation $$\ln \pi = \ln(A) + \beta_0 + \beta_1[lnk_1 + lnPL - lnA] + \beta_2[lnk_2 + lnPC - lnA] + \beta_3[lnk_3 + lnPR - lnA]$$ $$+\frac{1}{2}[\beta_{11}(lnk_1 + lnPL - lnA)*(lnk_1 + lnPL - lnA)] + \frac{1}{2}[\beta_{12}(lnk_1 + lnPL - lnA)*(lnk_2 + lnPC - lnA)]$$ $$+\frac{1}{2}[\beta_{13}(lnk_1 + lnPL - lnA)*(lnk_3 + lnPR - lnA)] + \frac{1}{2}[\beta_{21}(lnk_2 + lnPC - lnA)*(lnk_1 + lnPL - lnA)]$$ $$+\frac{1}{2}[\beta_{22}(lnk_2 + lnPC - lnA)*(lnk_2 + lnPC - lnA)] + \frac{1}{2}[\beta_{23}(lnk_2 + lnPC - lnA)*(lnk_3 + lnPR - lnA)]$$ $$+\frac{1}{2}[\beta_{31}(lnk_3 + lnPR - lnA)*(lnk_1 + lnPL - lnA)] + \frac{1}{2}[\beta_{32}(lnk_3 + lnPR - lnA)*(lnk_2 + lnPC - lnA)]$$ $$+\frac{1}{2}[\beta_{33}(lnk_3 + lnPR - lnA)*(lnk_3 + lnPR - lnA)]$$ $$-ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right] * \left[\begin{matrix}\beta_{11}(lnk_1 + lnPL - lnA) + \beta_{22}(lnk_2 + lnPC - lnA) \\ + \beta_{33}(lnk_3 + lnPR - lnA)\end{matrix}\right]$$	π
Share Equation for Labour $$Q_L = \beta_1 + \beta_{11}(lnk_1 - lnA + lnPL) + \beta_{12}(lnk_2 - lnA + lnPC) + \beta_{13}(lnk_3 - lnA + lnPR)$$ $$-\beta_{11} * ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]$$	Q_L
Share Equation for Capital $$Q_C = \beta_2 + \beta_{22}(lnk_2 - lnA + lnPC) + \beta_{12}(lnk_1 - lnA + lnPL) + \beta_{23}(lnk_3 - lnA + lnPR)$$ $$-\beta_{22} * ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]$$	Q_C
Share Equation for Raw Material	Q_R

$Q_R = \beta_3 + \beta_{33}(lnk_3 - lnA + lnPR) + \beta_{13}(lnk_1 - lnA + lnPL) + \beta_{23}(lnk_2 - lnA + lnPC) - \beta_{33} * ln\left[1 + \left[\frac{(1-k_1)}{k_1} + \frac{(1-k_2)}{k_2} + \frac{(1-k_1)}{k_3}\right]\right]$	
The Farm Supply Equation $FS = \beta_0 + \beta_1 * TT + \beta_2 * FS(-1) + \beta_3 * MCP$ ***For Supply-Managed Sub-sectors,*** $MCP = FP - QV$	*FS, MCP, QV* (for supply-managed sub-sectors). *FS, FP* (for non supply-managed sub-sectors)
The Producer Surplus Identity $PS = -\left(\frac{3c^2}{4d}\right) - \frac{c}{2d}\beta_1(k_1 * PL / A) - \frac{c}{2d}\beta_2(k_2 * PC / A) - \frac{c}{2d}\beta_3(k_3 * PR / A) + \frac{3}{4d} * \frac{1}{2}\beta_{11}(k_1 * PL / A)^2 + \frac{3}{4d} * \frac{1}{2}\beta_{22}(k_2 * PC / A)^2 + \frac{3}{4d} * \frac{1}{2}\beta_{33}(k_3 * PR / A)^2 + \frac{3}{4d}\beta_{12}(k_1 * PL / A) * (k_2 * PC / A) + \frac{3}{4d}\beta_{13}(k_1 * PL / A) * (k_3 * PR / A) + \frac{3}{4d}\beta_{23}(k_2 * PC / A) * (k_3 * PR / A)$	*PS*

where

π	= normalized profit (ie profit divided by price of output)
PR	= normalized price of raw material
k	= allocative efficiency term
Q_L	= quantity of labour demanded
Q_R	= quantity of raw material or input demanded
TT	= time trend
MCP	= marginal Cost Price for producers
FP	= farm price
PL	= normalized price of labour
PC	= normalized price of capital
A	= technical efficiency term
Q_C	= quantity of capital demanded
FS	= farm supply
FS(-1)	= lagged dependent variable
QV	= quota value of producing the input
PS	= producer surplus identity

Table 51: Table Showing The Simulations Of Effects Of Efficiency Changes On The Profit, Producer Surplus, Member Welfare And Quantity Of Produce Used By The Various Sub-Sectors.

	Dairy	Poultry & Egg	Fruit & Vegetable	Honey & Maple	Grain & Oilseed	Livestock
Unrestricted						
Profit ($)	94,700,451	43,359,780	18,510,777	3,582,593	462,439,219	6,790,900
Producer Surplus ($)	10,854,442.63	6,486,937	2,627,462	978,097	69,208,517	927,554
Member Welfare	105,554,893.63	49,846,717	21,138,239	4,560,690	531,647,736	7,718,454
Quantity of Input Used (Tonnes)	5,526,320	813,741	146,470	16,358	1,521,600	103,976
Equal Technical Efficiency(ETE)						
Profit ($)	106,420,135	45,089,670	19,314,000	3,747,009	475,900,000	7,000,110
Producer Surplus ($)	11,000,034	6,521,740	2,786,002	986,500	69,700,200	980,550
Member Welfare	117,420,169	51,611,410	22,100,002	4,733,509	545,600,200	7,980,660
Quantity of Input Used (Tonnes)	5,774,908	835,213	150,450	16,620	1,649,000	104,980
Absolute Allocative Efficiency (AAE)						
Profit ($)	108,093,790	45,865,431	19,500,000	3,800,668	469,614,700	6,900,300
Producer Surplus ($)	11,176,046	7,004,998	2,805,704	998,700	70,000,028	1,000,764
Member Welfare	119,269,836	52,870,429	22,305,704	4,799,368	539,614,728	7,901,064
Quantity of Input Used (Tonnes)	5,932,066	865,783	152,068	16,900	1,693,862	105,730
Equal Economic Efficiency (EEE)						
Profit ($)	112,950,090	48,367,801	19,905,022	3,970,900	478,409,885	7,050,000
Producer Surplus ($)	12,006,895	6,998,000	2,812,095	1,041,000	70,935,744	1,000,500
Member Welfare	124,956,985	55,365,801	22,717,117	5,011,900	549,345,629	8,050,500
Quantity of Input Used (Tonnes)	5,980,468	878,091	154,800	17,080	1,792,711	106,400

Table 52: Table Showing The Percent Increase In The Profit, Producer Surplus, Member Welfare And Quantity Of Produce Used By The Various Sub-Sectors.

	Dairy	Poultry & Egg	Fruit & Vegetable	Honey & Maple	Grain & Oilseed	Livestock
Percent Increase By ETE						
Profit (%)	12.38	3.99	4.34	4.59	2.91	3.08
Producer Surplus (%)	1.34	0.54	6.03	0.86	0.71	5.71
Member Welfare (%)	11.24	3.54	4.55	3.79	2.62	3.40
Quantity of Input Used (%)	4.50	2.64	2.72	1.60	1.80	0.97
Percent Increase By AAE						
Profit (%)	14.14	5.78	5.33	6.09	1.55	1.61
Producer Surplus (%)	2.96	7.99	6.78	2.11	1.14	7.89
Member Welfare (%)	12.99	6.07	5.52	5.23	1.50	2.37
Quantity of Input Used (%)	7.34	6.39	3.82	3.31	4.75	1.69
Percent Increase By EEE						
Profit (%)	19.27	11.55	7.53	10.84	3.45	3.82
Producer Surplus (%)	10.62	7.88	7.02	6.43	2.49	7.86
Member Welfare (%)	18.38	11.07	7.47	9.89	3.33	4.30
Quantity of Input Used (%)	8.22	7.91	5.69	4.41	6.65	2.33

The results in Table 51 show a general increase in profit, producer surplus, member welfare and quantity of input used by the various sub-sectors when efficiency is increased. For all the sub-sectors, when equal economic efficiency restriction is imposed, there is a significant increase in the profit, producer surplus, member welfare and quantity of input used by the sub-sectors. The same is true when equal technical and absolute allocative efficiencies are imposed. However, the percentage increase for the supply-managed sub-sectors is higher than the non supply-managed sub-sectors (Table 52). The simulation results also confirm that the various sub-sectors are not operating efficiently and this is evident in their profits, producer surplus, member welfare and the quantity of input they use. Co-operatives in the sub-sectors will have to increase their technical and allocative efficiencies to attain higher profits and producer surplus. The profit, producer surplus and member welfare of supply-managed co-operatives increase relatively more when there is equal economic efficiency among the individual co-operatives in those sub-sectors. This may suggest potential growth in these sub-sectors given an improvement their in efficiencies. However, one significant message is clear from the results; increases in efficiency in all sub-sectors will effect significant gains in the profits, producer surplus and quantity of input used by the co-operatives.

Comparing the results to other studies, it is seen that the results are consistent with other studies on efficiency in marketing co-operatives. Hailu (2005), in his study on cost efficiency in agricultural marketing co-operatives in Canada, found that for large dairy co-operatives, efficiency scores range between 70 and 80 percent. Small size dairy co-operatives had lower efficiency scores. According to Hailu, grain and oilseed co-operatives were less efficient than the dairy co-operatives while fruit and vegetable and

honey and maple co-operatives had lower cost efficiency than dairy and grain and oilseed co-operatives. The results in this study suggest that there are inefficiencies in all the sub-sectors and the supply-managed co-operatives respond more to improvements in efficiency.

5.6 Summary of the Chapter

Estimation results of the profit function and input demand equations were reported and discussed in this chapter. From the efficiency estimation using the profit function, it was found that both supply-managed and non supply-managed co-operatives are economically inefficient. Input demand elasticity estimations were also carried out from the models estimated. From the elasticity estimates, it was found that there is a relatively large change in the demand for inputs with a change in prices of the inputs, i.e. the demand is very elastic. The simulation results also showed that for all the sub-sectors, there is a significant increase in the profit, producer surplus and quantity of input used by a sub-sector as efficiency is increased. Also, the profit, producer surplus and member welfare of supply-managed co-operatives increase relatively more to improvements in efficiency.

Based on the results obtained and discussed in this chapter and the previous chapter, conclusions are drawn and recommendations are made in the next chapter. A general summary of the whole study and limitations to the study are also outlined in the next chapter.

6.0 CHAPTER SIX: SUMMARY, CONCLUSIONS AND LIMITATIONS

6.1 Introduction

In this chapter, a summary is made of the study and some conclusions are derived from the results obtained. Limitations of the study are also presented and some possible areas for further research are recommended.

6.2 Summary of the Thesis

Over the years, marketing co-operatives have contributed substantially to the economy of Canada. The operations and performance of marketing co-operatives are therefore worth studying. Marketing co-operatives have changed structure over the past two decades: some have merged, changed ownership or gone out of business. Also, the supply management system has been in place in Canada for over three decades now and some of these marketing co-operatives operate under supply management. Does supply management have an influence on these trends? Supply management applies centralized control over the quantity and price of one or more commodities. How does supply management affect the performance of the co-operatives operating under it as compared to those in sectors that do not have supply management? This study sought to answer this question.

The primary objective of this study was to assess the effect of the regulatory environment on the performance of marketing co-operatives in Canada. The specific objectives of the study were to compare the performance of marketing co-operatives in sectors that are supply-managed and those that are not and also to determine what the

implications are for producers and consumers with marketing co-operatives under the regulatory environment or without.

This study is of significant importance because apart from the study by Janmaat (1994), no study has been done on the effect of supply management on co-operatives. The study therefore bridges a gap in literature on supply management and performance of marketing co-operatives. The principles and theory of co-operatives and how these affect their behaviour were discussed in Chapter Two. The economics and marketing strategies of marketing co-operatives were examined to help understand their objectives and how they operate. Literature on how supply management affects processors, producers and consumers was examined in Chapter Two. Studies on firm performance measurement and effect of regulation on performance were discussed. The measures of performance chosen for this study were financial ratio analysis and profit, input demand and efficiency function estimation. The financial ratio analysis captures the financial performance of the co-operatives and the profit and efficiency estimation measures the how efficient the co-operatives are performing. Financial data from 1984 to 2001 were obtained from the annual survey of agribusiness co-operatives conducted by the Canadian Co-operative Secretariat (CCS), Government of Canada. The financial data is an unbalanced panel data set consisting of 6085 observations of an average of about 312 supply and marketing co-operatives. The marketing co-operatives studied were dairy, poultry and egg, honey and maple, fruit and vegetable, grain and oilseed and livestock co-operatives. The study estimated financial ratio analysis and profit maximization function for the various marketing co-operatives. The formulations of these measures were explained in detail in Chapter Three. The financial ratios calculated in this study are profit margin and current

ratio. Profit margin and current ratio were chosen because they are a measure of profitability and liquidity respectively. Profitability and liquidity measures are the most representative and most commonly used measures of performance. These ratios were regressed on some exogenous factors: firm size, membership size, time trend, financial leverage and input size. This analysis was carried out for individual co-operatives in the various sectors. The results obtained from the financial ratio analysis suggested that financial ratios are indeed affected by the factors outlined in Chapter Three and that financial performance of supply-managed co-operatives is comparable with their non supply-managed counterparts. That is, no distinct differences were found between these.

Profit efficiency estimation was also carried out to determine the efficiency of regulated and non-regulated co-operatives. Profit function and efficiency estimations were carried out on groups of individual co-operatives. The co-operatives were grouped based on their assets and profits. The results obtained from these estimations showed that neither the supply-managed nor the non-supplied co-operatives were efficient. Four different restrictions were imposed on the unrestricted profit functions to determine whether the individual co-operatives in any particular group had the same technical, allocative or economic efficiency. The likelihood ratio test was used to test these hypotheses. The results obtained showed that the co-operatives do not have equal technical, allocative or economic efficiencies: almost every co-operative has its own level of efficiency. Price elasticities of input demand were also estimated from the parameters estimated in the profit and efficiency estimation. The results obtained showed that the demand for inputs were very responsive to the price of inputs with the demand for labour being the most sensitive. Simulations carried out on the profit and efficiency models

showed that when there is equal economic efficiency, equal technical or absolute allocative efficiency among the co-operatives in a sub-sector, their profit, producer surplus and the quantity of input they use increase. This suggests that when efficiency is improved, there would be increases in productivity.

6.3 Conclusions

From the financial ratio analysis, it was found that on the whole, the responsiveness to the various factors in profit margin and current ratio by the regulated and non-regulated co-operatives were comparable. The elasticities of the regulated co-operatives were less elastic as compared to those for the non-regulated co-operatives. The regulated co-operatives did not exhibit any undue advantage over the non-regulated co-operatives that might be attributed to supply management. Results from the profit and efficiency estimations showed that the individual co-operatives are not technically or allocatively efficient. Hypotheses testing for equal economic efficiency, technical efficiency and allocative efficiency were all rejected for supply-managed and non-supply managed co-operatives alike. Looking at the input demand elasticity results reported in Tables 96 to 104 in the Appendix to Chapter Five, it is observed that the magnitude of the elasticities were quite high. This indicates that a small change in the price of an input results in a large change in the quantity demanded of that input or another input. On the whole, the price elasticities were found to be elastic. Simulation results also showed that co-operatives in the various sub-sectors are not operating efficiently. The profit, producer surplus and quantity of input used by the co-operatives increase with an increase in efficiency, with the dairy sub-sector having the highest increase with an improvement in efficiency.

Given the results obtained from the study, there are some policy implications to be considered. Supply-managed co-operatives are not performing any better than the non supply-managed co-operatives. Are producers and consumers benefiting from supply management as they should? From the simulation results, it was found that with improvements in efficiency in both the supply-managed and non supply-managed sectors, there is an increase in producer surplus, member welfare and quantity of inputs supplied. Producers will benefit from increased member welfare if the efficiency of the sectors in which they are is improved. The percentage increase in member welfare in the supply-managed sub-sectors is higher than in the non-supply managed sub-sectors. Consumers will benefit from increased quantity that the co-operatives produce. For the supply-managed sector, since they are not able to export any of these, there will be increased quantity and this will drive the retail price of these products down and consumers will benefit from the lower retail prices. In supply management therefore, consumer benefits are domestic but in the non supply-managed sectors, consumer benefits are potentially world wide as the increased quantity may end up being exported.

Non supply-managed co-operatives have also been found to be inefficient like the supply-managed co-operatives. There is an issue of inefficiencies in the operation of co-operatives: supply-managed and non supply-managed co-operative alike. Attaining economic efficiency in supply-managed sub-sectors may be difficult due to the rigid nature in which provincial quota is allocated. The quota allocated to provinces is fairly fixed which does not take into consideration growth in provinces. Co-operative managers should be educated on efficiency measures that they can practice to make the co-operatives more efficient and be able to maximize profits. Supply-managed co-operatives

may have to be more concerned about improving efficiency since it is seen from the simulation results that increased efficiency results in a significant increase in the profit and producer surplus of co-operatives in the supply-managed sub-sectors (Table 51). The demand for inputs used by the co-operatives has been found to be very responsive to price changes. The input market therefore plays a major role in the operation of these co-operatives and slight distortions in these markets will cause greater changes in the quantity demanded for these inputs. The input market should therefore be controlled to avoid such distortions.

6.4 Limitations

While the above conclusions are vindicated on the basis of rigorous theoretical and empirical techniques, the study possesses a few limitations. The estimations carried out in this study were carried out on individual co-operative level. However, due to lack of sufficient data for most individual co-operatives, the co-operatives with less sufficient data points were left out of the estimation, thus reducing the number of co-operatives estimated. For the efficiency estimation, a welfare maximization function was outlined in Chapter Three to capture the producer surplus components for co-operatives. In carrying out this estimation, specification of the producer surplus component proved to be very difficult. The producer surplus component was therefore left out of the profit function due to time constraint and so the traditional profit function was estimated. However, the producer surplus identity was specified and used in the simulation models in equation 5.17 in Chapter Five. The data obtained for this study are confidential and the identity of the individual co-operatives is unknown. Therefore not much could be inferred from the results obtained from the results. The geographical locations for instance of these co-

operatives are not known and therefore much could not be said about their behaviours relative to where they are located in the country.

6.5 Recommendations for Future Research

In light of the above limitations, a number of potentially fruitful areas of further research are proposed. Since this study carried out estimations on individual co-operative level, it may be helpful to carry out analysis of the various sectors as a whole in future research for comparison. Also, with regards to the efficiency estimation, future work can be done to determine the reason why the co-operatives are inefficient and find solutions to eradicate or reduce these inefficiencies. Another area of research that can be explored is using the cost minimization approach to measure efficiency in co-operatives keeping in mind supply-management. The same study can also be carried out on investor-owned firms that are supply-managed and those that are not and the results can be compared with the ones obtained in this study. Since there is very little study on the effect of supply management on performance of marketing co-operatives, it would be a good idea to explore different measures of performance so that there will be literature available in this area of research. An in-depth study on the effect of improved efficiency on the performance of marketing co-operatives may be carried out in future. Perhaps knowing the identities and origin of the co-operatives may also help in the understanding of their behaviour and how their environment has contributed to their behaviour.

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APPENDIX TO CHAPTER TWO

Table 53: Summary of Firm Performance Studies

Author/ year / Study	Objective	Research Methods/tools	Findings
Lerman Z. and C. Parliament. 1990. **Estimating the profitability of pool cooperatives.**	To measure accounting profitability of a pool cooperative as a firm.	They used profitability measures of rate of return to assets and the rate of return to equity. They also introduced a technique for estimating the profitability of pool cooperatives that do not include raw products in their cost of goods sold and those that did.	Results indicated that the profitability estimates obtained by the procedure for cooperatives that do not report raw product costs are comparable to the profitability ratios of cooperatives that do report raw product costs.
Parliament C., Z. Lerman Z. and J. Fulton. 1990. **Performance of cooperatives and investor owned firms in the dairy industry.**	To compare the financial performance of cooperative and investor owned dairies	They used four financial ratios: profitability, leverage, solvency, and efficiency.	The median performance of cooperatives was significantly better than the median performance of IOFs in terms of leverage, coverage, and efficiency and not worse in terms of profitability.

Harris A. and M. Fulton. 1996. **Comparative financial performance analysis of Canadian cooperatives, investor owned firms and industry norms.**	To empirically examine the financial performance of Canadian cooperatives and to compare this performance with that of IOFs and industry norms.	Their methodology focused on comparing a number of accounting ratios and growth rates which provide insight into the liquidity, profitability, productivity, leverage, and growth of a firm.	The results from the comparisons of profitability measures for cooperatives and IOFs suggest that although cooperatives may not theoretically hold profit maximization as their primary objective, there is little evidence to suggest that this has had a significant impact upon their reported rates of return. Cooperatives operating in all of the sectors analyzed in this study appear to be more liquid in the short-run than other firms in their industry.
Chapman, B.A. and Christy, R. D. 1989. **The comparative performance of cooperatives and investor owned firms: The Louisiana sugar manufacturing industry.**	-To provide a conceptual argument for evaluating the economic performance of alternative business organizations (ie private versus cooperative). -To describe the organizational features of the Louisiana cane sugar manufacturing industry -To evaluate the economic performance of private and cooperatively owned sugar mills in Louisiana.	Two measures of economic performance were evaluated: average total costs per pound of raw sugar produced, and the profit-volume ratio, or net income per dollar of sales.	The costs and returns from the past nine grinding seasons suggest that private processors on average operated at higher total cost per unit than cooperatives.

Lerman Z. and C. Parliament. 1990. **Comparative performance of food-processing cooperatives and investor-owned firms.**	To determine whether the difference in objectives between cooperatives and investor-owned firms outweighs the effect of the similarities in business functions. .	They did comparative analysis of financial performance of cooperatives and IOFs using financial ratios.	The rate of return to equity in cooperatives was not found to be significantly different from that of comparable IOFs; the debt to equity and the earnings to interest ratios for cooperatives were not found to be higher than for the comparable IOFs.
Raju, S. J. and A. Roy. 2000 **Market information and firm performance**	To understand how the value of information depends on industry and firm characteristics.	They based their model on the asymmetric duopoly theory and solved for the equilibrium pricing strategies and the resulting equilibrium profits in the market.	Industry size does not affect the value of superior information. Also, additional information has a stronger positive impact on profits in a Stackelberg mode of conduct than in a Nash mode.
Katz, J. P. 1985. **Managerial behaviour and strategy choices in agribusiness cooperatives.**	To examine the role owners and managers play in affecting the strategic choices and performance of agribusiness firms, specifically user-owned agribusiness cooperatives.	He used a linear regression equation to analyze the effects of organizational factors on firm productivity.	The relationship between firm performance and organizational strategies was found to be related to the ownership structure of the firm.

O'Mara C.E., P.W. Hyland and R.L. Chapman. 1998. **Performance measurement and strategic change**	To evaluate the manager's perceptions of strategy/performance measurement relationship, and the responsiveness of performance measures to changes in strategy.	Structured interviews were conducted on various levels of management within the organizations.	The results showed that there was no formal recognition of a link between strategic changes and performance measurement.
Beierlein J.G. and C.A. Miller **Performance measures, and measurement in supply chains in the food system.**	To measure performance in supply chains in the food system.	They used a mail survey which asked the subscribers to rate carrier performance in five areas: on-line performance, value, information technology, customer service, and equipment and operations.	The results revealed that the combination of right market environment and the evolution of information technology yield greater efficiencies in the food system.
Powell K. and S. Szymansk. 1997. **Regulation through comparative performance evaluation.**	To show that comparative performance regulation is optimal and also to show that where the benefits of cost reducing activities accrue equally to all members of the industry, an optimal comparative regime does not exist.	They developed a simple model of regulation through comparative performance evaluation.	Results show that it is possible to design an optimal regulatory contract based on comparative performance evaluation.

Fox K., Q. Grafton, J. Kirkley and D. Squires. 2003. **Property rights in a fishery: regulatory change and firm performance.**	To apply a new methodology to derive profit and productivity decomposition measures.	They used a productivity and profit decomposition method derived from theoretical results based on the relationship between the Tornqvist index and the translog profit function.	The index decompositions provide a breakdown of the relative importance of regulations on firm performance. The results also indicate that regulatory change can lead to significant productivity shocks among firms, but that firms can adjust rapidly to such shifts.
Salerian J. 2003. **Analysing the performance of firms using a decomposable ideal index number to link profit, prices and productivity.**	To review an integrated framework that enables the change in the economic profit of an industry or firm (measured as revenue divided by cost) to be decomposed into the contributions from the changes in the prices and quantities of key outputs and inputs.	He decomposed the changes by using logarithmic Fisher's ideal index.	The logarithmic version of Fisher's ideal index offers a useful way of integrating profit and productivity analysis. It offers the ability to trace the sources of change to prices and quantities of key individual outputs and inputs.
Jarvis R., J. Curran, J. Kitching and G. Lightfoot. 1999. **The use of quantitative and qualitative criteria in the measurement of performance in small firms.**	To investigate and identify the performance measures adopted by owner-managers of small firms, exploring both the rationales for their use and the consequences of adopting such measures	Face-to-face, semi-structured interviews were conducted with owner-managers of small businesses.	Although according to conventional economic theory, profit should be the key indicator of business performance, owner-managers themselves do not claim to rely much on this indicator.

Fraquelli G. and D. Vannoni. 2000. **Multidimensional performance in telecommunications, regulation and competition: analyzing the European major players.**	To assess the role of incentive regulation and market structure in determining performance levels.	They used accounting measures (ie the ratio between operating profits and assets).	While a different regulatory regime is able to influence productivity, a higher level of competition seems to be the only way for a strong reduction of prices to benefit the final consumer.
Qu R., C. Ennew and M.T. Sinclair. 2004 **The impact of regulation and ownership structure on market orientation in the tourism industry in China.**	To examine the impact of regulation on competition and product quality.	Analysis of interview data was carried out.	The results suggest that some extent of regulation can, in fact, be beneficial.
Ramaswamy K., A.S. Thomas, and R.J. Litschert. 1994. **Organizational performance in a regulated environment: The role of strategic orientation.**	To explore the relationship between strategy and performance in the regulated airline industry	They used a longitudinal time frame and multiple objective measures of strategy and performance.	The results supported the contention that firms in the regulated airline industry were able to implement coherent strategies in order to achieve superior profitability.

Oustapassidis K., A. Vlachvei, and K. Karantininis. 1998. **Growth of investor owned and cooperative firms in Greek dairy industry.**	To compare the growth of cooperatives and IOFs in the Greek dairy sector over the period 1990-94.	They developed a model of strategic firm growth to test the significance of various factors affecting growth and whether there are differences in the way these factors affect cooperatives and IOFs.	The results show that cooperatives do not intensively apply certain strategies (advertising and diversification) like IOFs.
Kald, M. and Nilsson, F. 2000. **Performance Measurement At Nordic Companies.**	To understand how systems of performance measurement have been designed and used in the Nordic countries.	They administered questionnaire to 800 business units. The questionnaire covered many of the central issues relating to the design and use of performance measurement.	The study found that performance measurement at Nordic companies meets many criteria for modern management control. The study also indicates that measures are relatively developed and it combines both financial and non-financial measures.
Hardesty, S.D. and Salgia, V. D. 2004. **Comparative Financial Performance of Agricultural Cooperatives and Investor-Owned Firms.**	To access the validity of claims that cooperatives are destroying value.	They used traditional financial ratios measuring profitability, liquidity, leverage and asset efficiency to compare the financial performance of agricultural cooperatives with investor-owned firms in four sectors – dairy, farm supply, fruit and vegetable and grain.	Overall, they found that the financial performance of agricultural cooperatives and their investor-owned counterparts were comparable. The cooperatives demonstrated lower rates of asset efficiency, were less leveraged. The results regarding the relative profitability and liquidity of cooperatives were not conclusive.

Tennbakk, B. 2004. **Cooperatives, Regulation and Competition in Norwegian Agriculture.**	To analyze the efficiency of current market regulations and market structure in Norwegian agriculture.	Mixed market model (mixed duopoly) in which a marketing cooperative and an investor-owned wholesaler (IOW) compete in the market is used.	The analysis shows that the market result cannot be fully understood without taking the market structure and objective functions of market players into account. It is also shown that competition between the marketing cooperative and IOWs, the cooperatives' cost distribution rules, and the cooperatives' dual role as market player and government agent contribute to the costs of over production.

APPENDIX TO CHAPTER THREE

Table 54: Table Showing Total Assets Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001)

Year	F0478	F0559	F1322	E0296	F1820	E0305	A0205	F0267	E0152	F1399
1984	43,086,527	3,527,152	8,385,683	2,819,570	83,683	11,884,008	11,884,008	50,699,848	38,584,000	17,826,848
1985	39,695,733	3,548,437	7,954,548	2,968,868	77,306	11,029,060	11,029,060	61,155,360	39,001,000	18,269,030
1986	36,114,940	3,374,288	7,768,348	3,236,531	111,055	11,592,640	11,592,640	94,041,672	39,711,000	17,410,910
1987	38,807,000	3,820,205	8,203,500	3,068,777	173,737	13,894,880	13,894,880	98,566,015	36,493,000	15,849,025
1988	47,637,575	4,820,275	9,183,035	3,115,329	160,480	16,673,855	16,673,855	94,111,410	42,122,000	18,673,645
1989	49,057,775	4,979,090	11,111,790	3,142,223	181,875	22,000,000	22,000,000	92,335,095	39,705,000	22,241,095
1990	41,564,855	5,199,361	10,823,705	3,147,305	195,312	21,339,000	21,339,000	56,721,200	46,623,000	49,610,000
1991	36,003,597	6,570,800	8,820,980	3,178,035	245,440	20,972,000	20,972,000	52,521,540	54,952,000	44,534,960
1992	34,226,369	6,831,421	8,160,150	3,511,457	248,441	25,107,000	25,107,000	53,778,131	52,065,000	44,494,374
1993	32,939,226	6,662,796	8,270,415	3,454,539	282,924	24,664,000	24,664,000	39,944,708	47,786,000	44,615,949
1994	34,975,714	7,460,198	8,303,155	3,815,049	350,397	24,989,000	24,989,000	44,855,330	51,628,000	52,800,000
1995	35,283,228	7,810,244	8,245,993	4,291,751	710,390	25,477,000	25,477,000	50,988,086	53,623,000	54,221,959
1996	34,122,380	7,790,739	8,669,309	4,326,534	387,743	24,065,000	24,065,000	54,396,095	54,665,000	56,677,223
1997	35,094,406	8,501,870	11,291,848	4,386,922	423,162	25,654,000	25,654,000	48,560,543	60,200,000	59,491,619
1998	36,212,511	7,537,685	11,473,399	4,517,617	491,028	25,716,251	25,716,251	44,070,350	63,749,000	69,031,588
1999	33,170,027	7,974,750	11,332,643	4,783,509	551,662	26,030,291	26,030,291	46,162,587	70,288,000	84,956,576
2000	22,179,281	6,971,909	10,039,145	5,089,120	614,861	31,089,776	31,089,776	45,877,462	74,748,000	115,351,102
2001	31,573,509	8,184,751	7,537,422	5,089,120	833,054	39,462,918	39,462,918	42,919,491	82,719,000	112,650,762
Std. Dev	6,112,972	1,789,726	1,397,357	769,994	223,115	7,267,235	7,267,235	20,082,458	13,386,573	30,728,235
Mean	36,763,592	6,198,110	9,198,615	3,774,570	340,142	22,313,371	22,313,371	59,539,162	52,703,444	49,928,148
Min	22,179,281	3,374,288	7,537,422	2,819,570	77,306	11,029,060	11,029,060	39,944,708	36,493,000	15,849,025
Max	49,057,775	8,501,870	11,473,399	5,089,120	833,054	39,462,918	39,462,918	98,566,015	82,719,000	115,351,102
Var	3.74E+13	3.20E+12	1.95E+12	5.93E+11	4.9E+10	5.28E+13	5.28E+13	4.03E+14	1.79E+14	9.44E+14

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 55: Table Showing Total Assets Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 – 2001)

Year	B0264	D0147
1984	41,830,700	6,247,872
1985	41,243,975	7,306,323
1986	51,010,855	6,646,146
1987	64,251,500	7,518,705
1988	64,089,425	9,191,770
1989	62,726,435	10,279,890
1990	70,049,460	12,083,560
1991	69,000,000	13,084,082
1992	71,072,909	10,989,984
1993	68,736,030	10,265,118
1994	78,628,241	11,844,344
1995	82,351,755	14,277,711

1996	88,258,504	18,591,014
1997	90,382,889	19,483,529
1998	100,669,773	23,331,588
1999	103,454,000	30,457,641
2000	131,143,000	31,270,877
2001	130,626,000	32,362,974
Std. Dev	**25,796,910**	**8,693,351**
Mean	**78,306,970**	**15,290,729**
Min.	**41,243,975**	**6,247,872**
Max	**131,143,000**	**32,362,974**
Var	**6.65E+14**	**7.55E+13**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 56: Table Showing Total Assets Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001)

Year	A0066	A0099	E0333
1984	16,326,360	9,851,975	6,433,557
1985	29,400,734	12,447,705	6,766,318
1986	23,325,430	11,102,600	8,415,108
1987	22,044,065	9,858,201	8,962,674
1988	23,943,070	12,845,864	10,061,040
1989	24,246,785	11,654,409	9,005,662
1990	28,573,940	11,204,468	9,253,788
1991	24,040,251	8,185,768	9,650,852
1992	23,792,926	6,064,319	11,228,495
1993	23,337,034	5,644,759	10,837,105
1994	22,563,946	5,834,950	7,188,576
1995	20,605,653	6,114,128	7,294,649
1996	24,938,365	6,806,105	7,261,193
1997	25,566,284	6,716,338	6,468,205
1998	25,566,284	5,993,922	9,117,168
1999	25,566,284	6,185,420	8,948,615
2000	25,566,284	6,507,522	12,545,499
2001	25,566,284	6,507,522	12,545,499
Std. Dev	**2,870,161**	**2,590,910**	**1,919,786**
Mean	**24,164,999**	**8,306,999**	**8,999,111**
Min.	**16,326,360**	**5,644,759**	**6,433,557**
Max	**29,400,734**	**12,845,864**	**12,545,499**
Var	**8.24E+12**	**6.71E+12**	**3.68E+12**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 57: Table Showing Total Assets Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 – 2001)

Year	B0085	D0145
1984	5,228,259	6,711,415
1985	6,295,025	6,297,513
1986	5,948,435	6,191,049
1987	6,527,934	7,312,766
1988	7,614,174	7,693,099
1989	6,658,241	7,813,460
1990	4,892,722	5,375,431
1991	4,895,000	5,152,707
1992	5,100,997	5,822,632
1993	6,151,036	5,529,073
1994	8,718,587	5,445,452
1995	10,321,491	5,326,931
1996	10,915,565	5,700,440
1997	10,180,789	6,547,466
1998	9,712,993	7,505,188
1999	10,252,009	8,842,687
2000	10,557,624	6,924,584
2001	11,333,887	9,682,970
Std. Dev	**2,357,145**	**1,282,289**
Mean	**7,850,265**	**6,659,715**
Min.	**4,892,722**	**5,152,707**
Max	**11,333,887**	**9,682,970**
Var	**5.56E+12**	**1.64E+12**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 58: Table Showing Total Assets Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 – 2001)

Year	E0192	C0001	E0234
1984	3,740,944	862,115,000	2,850,475
1985	3,098,695	708,481,000	2,703,682
1986	3,141,890	810,425,000	2,488,156
1987	3,892,260	713,075,000	2,727,620
1988	4,945,058	688,878,000	3,193,500
1989	5,046,795	713,579,000	2,596,568
1990	5,456,778	756,288,000	2,637,325
1991	4,889,919	823,958,000	2,645,133
1992	4,972,136	677,254,000	2,198,878
1993	7,716,057	856,062,000	3,657,471
1994	10,061,772	994,874,000	6,971,442
1995	11,466,775	1,112,152,000	9,189,628
1996	12,818,181	1,203,818,000	10,650,170
1997	11,631,758	1,289,278,000	12,264,520
1998	12,665,546	1,521,450,000	13,304,914

1999	12,797,987	1,636,398,000	12,673,679
2000	14,662,155	1,587,411,000	15,068,908
2001	14,884,093	1,542,897,000	17,706,041
Std. Dev	**4,301,007**	**347,858,411**	**5,301,934**
Mean	**8,216,044**	**1,027,688,500**	**6,973,784**
Min.	**3,098,695**	**677,254,000**	**2,198,878**
Max	**14,884,093**	**1,636,398,000**	**17,706,041**
Var	**1.85E+13**	**1.21E+17**	**2.81E+13**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 59: Table Showing Total Assets Of Individual Co-operatives In The Livestock Sub-sector (1984 – 2001)

Year	A0197	B0358
1984	3,491,765	10,360
1985	3,211,168	10,843
1986	3,100,840	11,565
1987	3,837,880	13,574
1988	4,636,350	13,759
1989	4,101,435	16,876
1990	3,991,585	18,535
1991	4,500,465	18,650
1992	4,657,717	18,612
1993	2,292,438	18,625
1994	2,410,548	18,950
1995	2,011,906	19,780
1996	2,368,551	19,902
1997	5,265,983	19,245
1998	3,914,424	19,780
1999	3,762,771	19,956
2000	7,068,914	21,987
2001	8,780,432	23,901
Std. Dev	**1,692,498**	**3,863**
Mean	**4,078,065**	**17,494**
Min.	**2,011,906**	**10,360**
Max	**8,780,432**	**23,901**
Var	**2.86E+12**	**1.49E+7**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 60: Table Showing Market Shares Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001)

(%)

Year	F0478	F0559	F1322	E0296	F1820	E0305	A0205	F0267	E0152	F1399
1984	3.08	0.32	0.65	0.09	0.01	0.17	0.62	4.13	2.72	1.06
1985	2.98	0.28	0.58	0.07	0.01	0.16	0.60	3.89	2.69	0.98
1986	2.24	0.19	0.53	0.08	0.01	0.16	0.54	3.72	2.23	0.85
1987	2.09	0.22	0.50	0.07	0.01	0.16	0.56	4.38	2.24	0.77

1988	2.30	0.22	0.50	0.08	0.01	0.16	0.68	4.50	2.21	0.91
1989	2.14	0.23	0.52	0.08	0.01	0.16	0.88	4.23	2.12	0.89
1990	2.03	0.22	0.50	0.07	0.01	0.16	0.74	2.46	1.93	2.03
1991	2.12	0.22	0.35	0.08	0.01	0.17	0.78	1.78	2.08	1.21
1992	2.07	0.22	0.34	0.09	0.01	0.17	0.80	1.67	2.34	1.21
1993	2.14	0.26	0.34	0.09	0.01	0.18	0.84	1.79	2.45	1.22
1994	2.23	0.30	0.34	0.09	0.02	0.18	0.86	1.93	2.55	1.20
1995	2.17	0.30	0.33	0.09	0.01	0.18	0.82	1.96	2.58	1.27
1996	1.97	0.32	0.33	0.10	0.02	0.18	0.83	1.90	2.58	1.42
1997	2.00	0.31	0.36	0.10	0.02	0.20	0.86	1.96	2.62	2.38
1998	2.04	0.31	0.19	0.10	0.02	0.19	0.88	1.26	2.58	2.45
1999	2.02	0.31	0.19	0.11	0.02	0.20	0.88	1.16	2.79	2.46
2000	1.81	0.26	0.21	0.11	0.02	0.23	0.88	1.08	2.94	2.79
2001	2.13	0.30	0.19	0.11	0.02	0.25	1.00	0.87	3.35	3.42
Std. Dev	**0.32**	**0.04**	**0.14**	**0.01**	**0.00**	**0.03**	**0.13**	**1.27**	**0.34**	**0.79**
Mean	**2.20**	**0.27**	**0.39**	**0.09**	**0.01**	**0.18**	**0.78**	**2.48**	**2.50**	**1.58**
Min.	**1.81**	**0.19**	**0.19**	**0.07**	**0.01**	**0.16**	**0.54**	**0.87**	**1.93**	**0.77**
Max	**3.08**	**0.32**	**0.65**	**0.11**	**0.02**	**0.25**	**1.00**	**4.50**	**3.35**	**3.42**
Var	**0.10**	**0.002**	**0.02**	**0.001**	**0.001**	**0.001**	**0.017**	**1.62**	**0.12**	**0.62**

Source: Calculated from Food Industries Catalogue No. 32-250-XPB and Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 61: Table Showing Market Shares Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 – 2001)

(%)

Year	B0264	D0147
1984	8.00	1.68
1985	8.62	1.57
1986	10.67	1.57
1987	11.60	1.46
1988	10.14	1.28
1989	10.27	1.46
1990	10.67	1.44
1991	11.03	1.64
1992	11.05	1.48
1993	10.13	1.43
1994	10.69	1.62
1995	11.39	1.94
1996	11.34	2.45
1997	11.96	2.75
1998	12.98	2.95
1999	13.39	2.96
2000	16.95	3.19
2001	13.37	2.33
Std. Dev	**1.99**	**0.63**
Mean	**11.35**	**1.95**

Min.	**8.00**	**1.28**
Max	**16.95**	**3.19**
Var	**3.94**	**0.40**

Source: Calculated from Food Industries Catalogue No. 32-250-XPB and Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 62: Table Showing Market Shares Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001) (%).

Year	A0066	A0099	E0333
1984	1.37	0.75	0.33
1985	1.57	0.56	0.35
1986	1.53	0.58	0.45
1987	1.39	0.53	0.44
1988	1.01	0.56	0.35
1989	1.05	0.49	0.35
1990	1.50	0.44	0.28
1991	1.35	0.47	0.36
1992	1.34	0.43	0.40
1993	1.26	0.43	0.30
1994	1.27	0.43	0.29
1995	0.99	0.37	0.37
1996	0.34	0.42	0.44
1997	0.70	0.42	0.23
1998	1.00	0.35	0.30
1999	0.94	0.41	0.23
2000	1.09	0.39	0.27
2001	1.18	0.39	0.27
Std. Dev	**0.31**	**0.10**	**0.07**
Mean	**1.16**	**0.47**	**0.33**
Min.	**0.34**	**0.35**	**0.23**
Max	**1.57**	**0.75**	**0.45**
Var	**0.10**	**0.01**	**0.00**

Source: Calculated from Food Industries Catalogue No. 32-250-XPB and Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 63: Table Showing Market Shares Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 – 2001) (%).

Year	B0085	D0145
1984	1.21	1.09
1985	1.24	0.98
1986	1.03	1.07
1987	0.88	0.80
1988	1.01	0.87
1989	1.01	0.89
1990	0.91	0.78

1991	0.98	0.78
1992	0.66	0.93
1993	0.69	0.90
1994	0.80	0.85
1995	0.92	0.96
1996	0.93	0.79
1997	1.10	0.92
1998	1.06	0.84
1999	1.17	0.94
2000	0.75	0.89
2001	0.72	0.78
Std. Dev	**0.17**	**0.09**
Mean	**0.95**	**0.89**
Min.	**0.66**	**0.78**
Max	**1.24**	**1.09**
Var	**0.03**	**0.01**

Source: Calculated from Food Industries Catalogue No. 32-250-XPB and Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 64: Table Showing Market Shares Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 – 2001) (%).

Year	E0192	C0001	E0234
1984	0.31	60.79	0.29
1985	0.34	51.66	0.29
1986	0.33	42.96	0.27
1987	0.32	44.76	0.23
1988	0.47	46.33	0.28
1989	0.47	40.95	0.26
1990	0.44	50.06	0.25
1991	0.43	54.02	0.23
1992	0.40	48.83	0.23
1993	0.61	42.77	0.34
1994	1.12	48.60	1.02
1995	1.06	56.93	0.88
1996	1.15	81.10	1.15
1997	1.12	82.77	1.13
1998	1.01	82.79	1.10
1999	0.95	68.53	1.03
2000	0.92	63.49	0.99
2001	0.95	59.44	1.06
Std. Dev	**0.33**	**13.82**	**0.40**
Mean	**0.69**	**57.04**	**0.61**
Min.	**0.31**	**40.95**	**0.23**
Max	**1.15**	**82.79**	**1.15**
Var	**0.11**	**191.12**	**0.16**

Source: Calculated from Food Industries Catalogue No. 32-250-XPB and Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 65: Table Showing Market Shares Of Individual Co-operatives In The Livestock Sub-sector (1984 – 2001) (%).

Year	A0197	B0358
1984	0.70	0.02
1985	0.73	0.02
1986	0.72	0.02
1987	0.71	0.02
1988	0.74	0.02
1989	0.72	0.02
1990	0.65	0.02
1991	0.68	0.02
1992	0.74	0.03
1993	0.80	0.02
1994	0.72	0.02
1995	0.61	0.02
1996	0.50	0.02
1997	0.68	0.02
1998	0.67	0.02
1999	0.21	0.02
2000	0.83	0.02
2001	1.03	0.02
Std. Dev	**0.16**	**0.003**
Mean	**0.69**	**0.02**
Min.	**0.21**	**0.02**
Max	**1.03**	**0.03**
Var	**0.03**	**0.0001**

Source: Calculated from Food Industries Catalogue No. 32-250-XPB and Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 66: Table Showing Membership Size Of Individual Co-operatives In The Dairy Sub-sector (1984 -2001)

Year	F0478	F0559	F1322	E0296	F1820	E0305	A0205	F0267	E0152	F1399
1984	2440	425	758	35	14	87	87	1683	3866	849
1985	2510	399	696	35	14	90	90	1650	3581	1195
1986	2550	379	695	35	14	73	73	1595	3636	1209
1987	2290	259	682	35	14	81	81	1595	3712	1220
1988	2199	257	661	35	14	80	80	1653	3697	909
1989	2104	255	645	35	13	116	116	1653	3750	914
1990	2006	245	484	35	12	81	81	1621	3770	1277
1991	2006	240	581	35	12	113	113	1584	3788	1240
1992	1776	253	555	35	11	126	126	1551	3798	1248
1993	1767	252	525	35	11	126	126	2318	3821	1314
1994	1606	260	511	35	11	126	126	1422	3895	1330

1995	1502	151	511	35	11	126	126	1376	3932	1337
1996	1368	250	446	35	11	126	126	1252	4028	1400
1997	1288	237	446	35	10	126	126	1188	4201	1400
1998	1191	231	329	35	10	154	154	644	4246	1405
1999	1075	231	377	34	10	99	99	646	4306	1400
2000	993	223	244	35	9	57	57	640	4391	1440
2001	930	148	297	35	6	210	210	626	4470	1345
Std. Dev	**537**	**73**	**149**	**0**	**2**	**35**	**35**	**464**	**271**	**180**
Mean	**1,756**	**261**	**525**	**35**	**12**	**111**	**111**	**1,372**	**3,938**	**1,246**
Min.	**930**	**148**	**244**	**34**	**6**	**57**	**57**	**626**	**3,581**	**849**
Max	**2,550**	**425**	**758**	**35**	**14**	**210**	**210**	**2,318**	**4,470**	**1,440**
Var	**288,168**	**5,269**	**22,343**	**0**	**5**	**1,254**	**1,254**	**215,615**	**73,531**	**32,404**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 67: Table Showing Membership Size Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 -2001)

Year	B0264	D0147
1984	830	511
1985	830	508
1986	930	508
1987	1000	300
1988	1000	300
1989	1000	215
1990	1200	215
1991	1200	199
1992	1200	199
1993	1100	186
1994	1100	172
1995	1050	182
1996	1200	192
1997	1200	198
1998	1010	207
1999	1200	206
2000	1200	188
2001	1288	184
Std. Dev	**137**	**120**
Mean	**1,085**	**259**
Min.	**830**	**172**
Max	**1,288**	**511**
Var	**18,637**	**14,421**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 68: Table Showing Membership Size Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 -2001)

Year	A0066	A0099	E0333
1984	347	558	46
1985	589	298	44
1986	611	298	42
1987	434	242	37
1988	432	229	39
1989	428	194	36
1990	419	179	37
1991	421	171	39
1992	416	134	36
1993	321	134	36
1994	321	105	35
1995	280	105	34
1996	280	99	35
1997	263	99	31
1998	263	90	32
1999	263	78	31
2000	263	74	31
2001	220	74	31
Std. Dev	**112**	**120**	**4**
Mean	**365**	**176**	**36**
Min.	**220**	**74**	**31**
Max	**611**	**558**	**46**
Var	**12,579**	**14,499**	**20**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 69: Table Showing Membership Size Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 -2001)

Year	B0085	D0145
1984	193	323
1985	182	302
1986	179	302
1987	179	272
1988	179	253
1989	179	227
1990	179	214
1991	180	280
1992	180	218
1993	236	218
1994	167	181
1995	183	182
1996	182	188
1997	180	188
1998	180	188
1999	178	188

2000	178	188
2001	170	176
Std. Dev	**14**	**49**
Mean	**182**	**227**
Min.	**167**	**176**
Max	**236**	**323**
Var	**206**	**2,391**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 70: Table Showing Membership Size Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 -2001)

Year	E0192	C0001	E0234
1984	600	89323	450
1985	650	89449	450
1986	650	89072	516
1987	650	88748	450
1988	650	88588	493
1989	650	87088	496
1990	700	88362	468
1991	700	88485	468
1992	700	85285	482
1993	700	85038	703
1994	880	83933	701
1995	825	81153	706
1996	945	75923	589
1997	945	74256	680
1998	949	74291	669
1999	950	74291	655
2000	936	73106	653
2001	948	72614	657
Std. Dev	**137**	**6,662**	**104**
Mean	**779**	**82,723**	**571**
Min.	**600**	**72,614**	**450**
Max	**950**	**89,449**	**706**
Var	**18,764**	**4.44E+7**	**10,784**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 71: Table Showing Membership Size Of Individual Co-operatives In The Livestock Sub-sector (1984 -2001)

Year	A0197	B0358
1984	2200	115
1985	2200	115
1986	2250	115
1987	2300	115

1988	2260	115
1989	2260	115
1990	2260	115
1991	2300	155
1992	2440	155
1993	2467	155
1994	2473	155
1995	2477	155
1996	2473	155
1997	2480	155
1998	2485	155
1999	2492	155
2000	2493	155
2001	2505	155
Std. Dev	**118**	**20**
Mean	**2,379**	**139**
Min.	**2,200**	**115**
Max	**2,505**	**155**
Var	**13,971**	**403**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 72: Table Showing Debt Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001)

Year	F0478	F0559	F1322	F0296	F1820	E0305	A0205	F0267	E0152	F1399
1984	33,614,495	2,565,783	6,287,874	1,294,479	22,568	6,579,787	6,579,787	34,872,341	24,318,000	10,722,198
1985	26,997,442	2,653,996	5,701,219	1,386,215	3,737	3,945,010	3,945,010	42,496,655	23,298,000	10,092,101
1986	21,369,432	1,139,383	5,072,627	1,530,666	9,529	3,360,495	3,360,495	66,785,586	22,162,000	8,079,642
1987	22,631,000	1,133,230	5,243,400	1,351,732	60,463	4,596,243	4,596,243	79,357,725	17,389,000	7,637,075
1988	28,861,690	3,055,070	5,756,530	1,231,700	26,805	6,000,000	6,000,000	70,553,460	21,260,000	8,572,340
1989	30,946,245	2,605,195	7,497,245	1,054,879	37,285	8,000,000	8,000,000	66,030,910	14,507,000	12,017,910
1990	24,472,575	2,740,080	7,939,450	874,815	35,255	11,009,000	11,009,000	27,803,770	20,808,000	28,451,300
1991	16,519,290	4,027,787	5,586,685	692,170	34,189	9,582,000	9,582,000	26,220,770	29,100,000	23,527,820
1992	14,513,335	4,352,402	5,145,839	886,340	41,871	14,141,000	14,141,000	28,949,244	24,934,000	23,584,138
1993	14,644,646	3,995,586	5,322,851	680,469	78,033	12,611,000	12,611,000	17,214,746	21,494,000	23,846,005
1994	15,380,795	4,770,445	5,277,982	898,805	110,705	11,709,000	11,709,000	21,060,232	25,685,000	31,687,000
1995	15,076,165	5,089,359	5,190,580	1,237,771	494,680	11,696,000	11,696,000	22,633,943	25,201,000	33,110,625
1996	13,982,099	4,859,918	5,535,669	1,178,791	177,684	9,832,000	9,832,000	25,059,000	23,858,000	35,402,513
1997	15,027,228	4,802,227	7,545,031	1,184,454	219,252	11,154,000	11,154,000	17,937,895	25,419,000	37,430,503
1998	15,345,759	3,706,800	6,321,989	1,276,043	266,500	9,947,897	9,947,897	17,871,077	26,043,000	38,898,500
1999	13,795,893	3,853,419	6,370,751	1,418,969	323,378	10,934,124	10,934,124	21,020,705	27,632,000	53,177,554
2000	13,361,899	2,632,723	5,938,550	1,693,077	383,951	14,026,331	14,026,331	30,648,413	28,631,000	89,237,115
2001	19,481,335	3,840,991	3,777,859	1,693,077	524,516	21,259,402	21,259,402	26,014,896	32,778,000	92,588,393
Std. Dev	**6,608,819**	**1,193,957**	**1,018,771**	**303,190**	**171,497**	**4,323,751**	**4,323,751**	**20,378,537**	**4,273,595**	**25,146,955**
Mean	**19,778,962**	**3,434,689**	**5,861,785**	**1,198,025**	**158,356**	**10,021,294**	**10,021,294**	**35,696,187**	**24,139,833**	**31,559,041**
Min.	**13,361,899**	**1,133,230**	**3,777,859**	**680,469**	**3,737**	**3,360,495**	**3,360,495**	**17,214,746**	**14,507,000**	**7,637,075**
Max	**33,614,495**	**5,089,359**	**7,939,450**	**1,693,077**	**524,516**	**21,259,402**	**21,259,402**	**79,357,725**	**32,778,000**	**92,588,393**
Var	**4.368E+13**	**1.43E+12**	**1.04E+12**	**9.192E+10**	**2.94E+10**	**1.87E+13**	**1.87E+13**	**4.153E+14**	**1.83E+13**	**6.324E+14**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 73: Table Showing Debt Of Individual Co-operatives In The Poultry and Egg Sub-sector (1984 – 2001)

Year	B0264	D0147
1984	23,868,200	3,531,565
1985	18,218,820	4,256,987
1986	23,070,900	3,290,391
1987	30,664,215	3,914,455
1988	36,152,735	6,362,680
1989	34,028,620	6,222,490
1990	41,257,635	7,410,780
1991	41,500,000	8,459,687
1992	42,398,355	6,083,264
1993	39,461,905	4,524,170
1994	47,989,837	5,209,553
1995	49,283,850	7,734,277
1996	58,112,678	10,954,378
1997	57,987,749	11,678,657
1998	66,037,625	14,541,149
1999	66,660,000	19,699,621
2000	90,522,000	18,424,859
2001	83,357,000	18,463,351
Std. Dev	**20,064,951**	**5,462,917**
Mean	**47,254,007**	**8,931,240**
Min.	**18,218,820**	**3,290,391**
Max	**90,522,000**	**19,699,621**
Var	**4.03E+14**	**2.98E+13**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 74: Table Showing Debt Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001)

Year	A0066	A0099	E0333
1984	10,703,805	7,749,220	5,759,331
1985	24,367,124	10,391,205	6,106,247
1986	16,955,865	9,527,260	7,754,658
1987	15,791,070	8,035,561	8,287,373
1988	17,470,880	11,056,633	9,382,150
1989	16,970,680	11,193,094	8,272,007
1990	22,347,865	10,744,653	8,501,499
1991	16,009,346	7,726,753	8,825,916
1992	14,005,392	4,079,284	10,402,963
1993	13,395,252	3,853,683	9,904,477
1994	12,509,432	4,813,594	6,241,465
1995	10,429,210	5,231,870	6,323,969
1996	14,399,220	6,005,966	6,271,234
1997	16,117,836	5,341,567	5,479,238
1998	16,118,837	5,049,887	8,113,275

1999	16,318,938	4,906,747	7,943,178
2000	16,468,935	6,025,537	11,516,067
2001	16,548,325	6,025,537	11,516,067
Std. Dev	**3,426,084**	**2,521,637**	**1,889,272**
Mean	**15,940,445**	**7,097,670**	**8,144,506**
Min.	**10,429,210**	**3,853,683**	**5,479,238**
Max	**24,367,124**	**11,193,094**	**11,516,067**
Var	**1.17E+13**	**6.36E+12**	**3.57E+12**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 75: Table Showing Debt Of Individual Co-operatives In The Honey and Maple Sub-sector (1984 – 2001)

Year	B0085	D0145
1984	3,817,746	5,121,458
1985	4,699,440	4,697,940
1986	4,261,547	4,756,468
1987	4,927,657	5,948,839
1988	6,029,632	6,300,697
1989	4,853,679	6,373,367
1990	3,072,490	3,898,774
1991	3,075,000	3,723,255
1992	3,252,460	4,489,048
1993	4,355,160	4,245,090
1994	6,549,747	4,273,181
1995	8,675,318	4,289,517
1996	8,136,210	4,478,709
1997	7,416,208	5,286,985
1998	8,667,058	6,272,592
1999	9,127,827	7,632,003
2000	8,615,865	5,976,514
2001	11,235,822	8,486,537
Std. Dev	**2,474,302**	**1,310,368**
Mean	**6,153,826**	**5,347,276**
Min.	**3,072,490**	**3,723,255**
Max	**11,235,822**	**8,486,537**
Var	**6.12E+12**	**1.72E+12**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 76: Table Showing Debt Of Individual Co-operatives In The Grain and Oilseed Sub-sector (1984 – 2001)

Year	E0192	C0001	E0234
1984	2,341,048	485,350,000	1,345,400
1985	1,656,755	357,010,000	1,152,668
1986	1,608,010	456,620,000	1,129,071
1987	2,364,580	368,225,000	1,503,524
1988	3,307,841	332,848,000	1,650,195

1989	3,434,705	382,564,000	1,524,106
1990	3,532,356	399,545,000	1,145,930
1991	3,347,398	457,177,000	1,594,855
1992	3,372,531	259,635,000	1,301,596
1993	5,740,777	474,622,000	2,130,915
1994	7,902,512	595,275,000	4,757,656
1995	9,327,826	668,452,000	6,520,111
1996	10,363,337	734,580,000	7,360,664
1997	8,824,730	784,621,000	8,373,323
1998	8,703,511	855,369,000	9,023,185
1999	7,665,337	998,140,000	8,107,588
2000	9,709,991	1,043,799,000	10,353,140
2001	9,732,954	1,047,461,000	12,832,423
Std. Dev	**3,224,455**	**258,335,683**	**3,899,224**
Mean	**5,718,678**	**594,516,278**	**4,544,797**
Min.	**1,608,010**	**259,635,000**	**1,129,071**
Max	**10,363,337**	**1,047,461,000**	**12,832,423**
Var	**1.04E+13**	**6.67E+16**	**1.52E+13**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 77: Table Showing Debt Of Individual Co-operatives In The Livestock Sub-sector (1984 – 2001)

Year	A0197	B0358
1984	3,008,174	1,175
1985	2,746,074	692
1986	2,684,255	684
1987	3,701,030	999
1988	4,475,540	874
1989	3,961,365	1,088
1990	3,836,000	897
1991	4,251,540	572
1992	4,045,709	668
1993	1,202,586	789
1994	1,120,019	803
1995	715,373	890
1996	1,145,318	868
1997	4,093,246	895
1998	2,465,511	952
1999	2,550,495	967
2000	4,270,972	978
2001	5,700,087	990
Std. Dev	**1,391,417**	**155**
Mean	**3,109,627**	**877**
Min.	**715,373**	**572**
Max	**5,700,087**	**1,175**
Var	**1.94E+12**	**23,958**

Source: Canadian Co-operatives Secretariat Financial Data (1984 – 2001)

Table 78: Total Value of Sales in the Various Sectors (1984 – 2001) ('$)

Year	Dairy	Poultry and Egg	Fruit and Vegetable	Grain and Oilseed	Livestock	Honey and Maple
1984	5,452,167,000	1,551,383,000	2,310,300,000	4,216,208,000	8,215,500,000	771,695,000
1985	5,817,199,000	1,665,733,000	2,320,498,000	4,250,406,000	8,248,452,000	786,842,000
1986	6,667,459,000	1,760,100,000	2,579,377,000	4,384,806,000	8,530,573,000	759,922,000
1987	6,883,200,000	1,858,200,000	2,841,600,000	4,457,700,000	9,128,700,000	784,200,000
1988	7,151,500,000	2,111,500,000	3,066,600,000	4,488,700,000	8,743,900,000	770,500,000
1989	7,348,800,000	2,239,900,000	3,082,800,000	4,526,800,000	8,722,800,000	840,600,000
1990	7,530,700,000	2,315,600,000	3,240,000,000	4,427,500,000	8,962,600,000	862,400,000
1991	7,576,400,000	2,271,400,000	3,295,400,000	4,314,900,000	8,486,700,000	874,500,000
1992	7,461,900,000	2,457,200,000	3,307,500,000	4,441,900,000	8,521,200,000	1,071,700,000
1993	7,318,900,000	2,572,400,000	3,513,300,000	4,503,200,000	9,215,500,000	1,145,300,000
1994	7,412,900,000	2,609,200,000	3,497,600,000	4,705,600,000	9,530,400,000	1,206,900,000
1995	7,795,500,500	2,612,600,000	3,760,300,000	5,266,600,000	9,561,200,000	1,338,900,000
1996	7,809,400,000	2,634,097,000	3,790,800,000	5,096,500,000	9,579,400,000	1,360,800,000
1997	7,856,321,000	2,680,600,000	3,805,700,000	5,109,800,000	9,631,000,000	1,402,600,000
1998	7,879,400,000	2,698,700,000	3,806,000,000	5,220,600,000	9,658,300,000	1,450,670,000
1999	7,901,600,000	2,780,000,000	3,845,780,000	5,245,600,000	9,678,000,000	1,570,300,000
2000	7,932,600,000	2,702,800,000	3,907,000,000	5,240,300,000	9,700,000,000	1,690,000,000
2001	7,951,900,000	3,740,800,000	3,906,000,000	5,560,700,000	9,760,000,000	1,750,800,000

Source: Food Industries Catalogue No. 32-250-XPB

APPENDIX TO CHAPTER FOUR

Table 79: Farm Prices of Produce used in Estimations (1984 – 2001)

Year	Milk ($/Kg)	Chicken ($/Kg)	Fruit ($/Kg)	Grains and Oilseeds ($/Kg)	Eggs ($/dozen)	Beef ($/Kg)	Vegetables ($/Kg)	Honey ($/Kg)
1984	3.15	2.77	1.62	0.33	1.17	1.80	0.88	1.76
1985	3.24	2.57	1.71	0.31	1.14	1.75	0.72	1.78
1986	3.31	2.59	1.73	0.29	1.12	1.76	0.69	1.47
1987	3.36	2.51	1.78	0.27	1.10	1.93	0.97	1.58
1988	3.42	2.61	1.69	0.30	1.17	1.89	0.80	1.52
1989	3.46	2.86	1.66	0.29	1.29	1.91	1.22	1.57
1990	3.51	2.85	1.79	0.25	1.28	1.96	1.22	1.64
1991	3.59	2.74	2.09	0.21	1.27	1.87	1.06	1.54
1992	3.65	2.68	2.09	0.24	1.30	1.90	0.92	1.55
1993	3.68	2.73	1.96	0.25	1.31	2.13	0.89	1.63
1994	3.70	2.65	2.01	0.28	1.33	2.03	1.06	1.78
1995	3.97	2.62	1.98	0.34	1.41	1.91	1.06	1.94
1996	4.11	2.97	2.08	0.43	1.52	1.81	0.94	2.00
1997	4.18	2.96	2.25	0.33	1.46	1.92	0.86	1.97
1998	4.21	2.88	2.33	0.30	1.43	1.94	0.94	1.68
1999	4.32	2.73	2.35	0.27	1.42	2.04	0.99	1.82
2000	4.56	2.72	2.30	0.27	1.45	2.20	1.04	2.23
2001	4.65	2.82	2.30	0.30	1.50	2.41	1.01	2.21

Source: Complied from Statistics Canada's CANSIM Table 329-0026

Table 80: Retail Prices of Produce used in Estimations (1984 – 2001)

Year	Butter and Cheese ($/Kg)	Chicken ($/Kg)	Fruit ($/Kg)	Grains ($/Kg)	Beef ($/Kg)	Honey ($/Kg)	Eggs ($/dozen)	Vegetables ($/Kg)
1984	4.92	2.99	2.58	0.44	2.91	2.35	1.68	1.05
1985	5.09	2.87	2.75	0.45	2.98	2.36	1.65	0.94
1986	5.17	3.12	2.99	0.44	3.05	2.44	1.64	1.04
1987	5.27	3.31	2.98	0.42	3.33	2.44	1.60	1.16
1988	5.46	3.36	3.06	0.41	3.38	2.66	1.66	1.12
1989	5.63	3.74	2.91	0.51	3.45	2.99	1.77	1.22
1990	5.81	3.94	3.13	0.47	3.58	3.38	1.81	1.22
1991	5.98	3.85	3.74	0.42	3.61	2.90	1.80	1.22
1992	6.03	3.84	3.36	0.42	3.56	2.60	1.77	1.22
1993	5.99	3.92	3.34	0.45	3.75	2.81	1.74	1.34
1994	5.98	3.72	3.31	0.48	3.78	2.99	1.79	1.26
1995	6.17	3.71	3.23	0.49	3.77	3.43	1.94	1.25
1996	6.30	4.07	3.27	0.55	3.67	3.58	2.06	1.11
1997	6.47	4.25	3.19	0.54	3.71	3.84	2.15	1.15
1998	6.63	4.19	3.34	0.53	3.77	4.36	2.18	1.28
1999	6.69	4.24	3.44	0.54	3.90	4.33	2.17	1.25
2000	6.80	4.40	3.26	0.55	4.36	4.32	2.20	1.28
2001	7.03	4.63	3.64	0.55	5.08	4.41	2.29	1.37

Table 81: Descriptive Statistics of the Individual Co-operatives Used In The Study

Dairy Cooperatives

(Values are for the Beginning and End of the period)

	Frequency	Period	Members (#)	Sales ('$)	Assets ('$)	Liability ('$)	Equity ('$)
A0205	18	1984 - 2001	87	33681573	11884008	6579787	5304221
			210	79127961	39462918	21259402	18203516
E0152	18	1984 - 2001	3866	1.48E+08	38584000	24318000	14266000
			4470	2.66E+08	82719000	32778000	49941000
E0296	18	1984 - 2001	35	5056437	2819570	1294479	1525091
			35	8481440	5089120	1693077	3396043
E0305	18	1984 - 2001	63	9197430	2842669	1562426	1280243
			45	20172183	7865157	3206051	4659106
F0267	18	1984 - 2001	1683	2.25E+08	50699848	34872341	15827507
			626	69555804	42919491	26014896	16904595
F0478	18	1984 - 2001	2440	1.68E+08	43086527	33614495	9472032
			930	1.70E+08	31573509	19481335	12092174
F0559	18	1984 - 2001	425	17715161	3527152	2565783	961369
			148	24097784	8184751	3840991	4343760
F1322	18	1984 - 2001	758	35275860	8385683	6287874	2097809
			297	15491683	7537422	3777859	3759563
F1399	18	1984 - 2001	849	58053464	17826848	10722198	7104650
			1345	2.72E+08	1.13E+08	92588393	20062369
F1820	18	1984 - 2001	14	578013	83683	22568	61115
			6	1569818	833054	524516	308538

Fruit and Vegetable Cooperatives

(Values are for the Beginning and End of the period)

	Frequency	Period	Members (#)	Sales ('$)	Assets ('$)	Liability ('$)	Equity ('$)
A0066	18	1984 -2001	347	12804212	16326360	10703805	5622555
			220	37356838	25566284	16118837	9447447
A0099	18	1984 - 2001	558	17417030	9851975	7749220	2102755
			74	15347784	6507522	6025537	481985
E0333	18	1984 - 2001	46	7694007	6433557	5759331	674226
			31	10498156	12545499	11516067	1029432

Poultry and Egg Cooperatives

(Values are for the Beginning and End of the period)

	Frequency	Period	Members (#)	Sales ('$)	Assets ('$)	Liability ('$)	Equity ('$)
B0264	18	1984 - 2001	830	1.24E+08	41830700	23868200	17962500
			1288	5.00E+08	1.31E+08	83357000	47269000
D0147	18	1984 - 2001	511	26054786	6247872	3531565	2716307
			184	87230872	32362974	18463351	13899623

Honey and Maple Cooperatives

(Values are for the Beginning and End of the period)

	Frequency	Period	Members (#)	Sales ('$)	Assets ('$)	Liability ('$)	Equity ('$)
B0085	18	1984 - 2001	193	9315834	5228259	3817746	1410513
			170	12647747	11333887	11235822	98065
D0145	18	1984 - 2001	323	8404750	6711415	5121458	1589957
			176	13688662	9682970	8486537	1196433

Grain and Oilseed Co-operatives

(Values are for the Beginning and End of the period)

	Frequency	Period	Members (#)	Sales ('$)	Assets ('$)	Liability ('$)	Equity ('$)
C0001	18	1984 - 2001	89323	2563228000	862115000	485350000	376765000
			72614	3305417000	1542897000	1047461000	495436000
E0192	18	1984 - 2001	600	13160706	3740944	2341048	1399896
			948	52572202	14884093	9732954	5151139
E0234	18	1984 - 2001	450	12272059	2850475	1345400	1505075
			657	59019323	17706041	12832423	4873618

Livestock Co-operatives

(Values are for the Beginning and End of the period)

	Frequency	Period	Members (#)	Sales ('$)	Assets ('$)	Liability ('$)	Equity ('$)
A0197	18	1984 - 2001	2200	57123835	3491765	3008174	483591
			2505	1.01E+08	8780432	5700087	3080345
B0358	18	1984 - 2001	115	1463390	10360	1175	9185
			155	2174113	18612	466	18146

Source: Compiled from the Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 82: Table Showing Current Ratios Of Individual Co-operatives In The Dairy Sub-sectors (1984 – 2001)

	Dairy									
Year	F0267	E0305	F0478	F0559	F1322	A0205	E0152	E0296	F1399	F1820
1984	1.19	1.52	1.16	2.26	0.96	1.28	1.51	2.30	1.02	2.54
1985	1.31	1.64	1.30	2.09	0.99	1.04	1.42	2.56	1.19	13.66
1986	1.13	1.29	1.33	2.98	1.12	1.40	1.55	2.39	1.52	8.70
1987	1.07	1.37	1.40	3.87	1.64	1.22	1.65	2.18	1.26	1.79
1988	1.03	1.44	1.36	3.41	1.65	1.25	1.59	2.62	1.53	3.77
1989	1.11	1.71	1.24	3.48	1.26	1.23	2.05	3.45	1.09	3.22
1990	1.44	1.15	1.25	2.61	1.05	1.16	1.59	2.11	1.35	3.73
1991	1.05	1.00	1.40	1.60	1.17	1.12	1.41	2.80	1.23	5.12
1992	0.99	0.91	1.32	2.34	1.31	0.52	1.46	2.24	1.14	4.61
1993	1.00	1.45	1.31	1.77	1.26	0.68	1.60	2.83	1.20	2.17
1994	1.12	0.84	1.27	1.35	1.28	0.69	1.58	2.54	1.09	2.39
1995	1.13	0.78	1.24	1.19	1.25	0.77	1.80	2.23	1.08	0.97
1996	1.06	1.07	1.25	1.25	1.20	0.87	1.93	2.43	1.06	2.57
1997	2.15	1.13	1.16	1.44	1.22	0.87	1.82	2.38	1.43	2.52
1998	1.74	1.25	1.11	1.55	1.35	0.89	2.04	2.62	1.52	2.26
1999	1.49	0.89	1.17	1.48	1.19	0.86	2.00	2.56	1.31	2.38
2000	1.38	1.01	1.20	1.75	1.19	0.78	1.82	2.35	1.16	1.85
2001	1.47	1.09	1.37	1.25	1.13	0.87	1.48	2.35	1.16	1.99

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 83: Table Showing Current Ratios Of Individual Co-operatives In The Poultry and Egg and Honey and Maple Sub-sectors (1984 – 2001

	Poultry and Egg		Honey and Maple	
Year	B0264	D0147	B0085	D0145
1984	1.15	1.33	1.03	1.05
1985	1.97	1.57	1.01	1.00
1986	2.03	1.70	1.02	1.06
1987	1.46	1.57	0.98	0.96
1988	1.79	1.31	0.97	1.02
1989	1.93	1.67	1.02	1.02
1990	1.52	1.58	1.04	0.97
1991	1.25	1.30	1.05	0.87
1992	1.26	1.90	1.08	0.87
1993	1.09	2.75	0.77	0.86
1994	1.09	1.82	0.79	0.82
1995	1.15	1.33	0.64	0.79
1996	1.35	1.42	0.72	1.01
1997	1.37	1.31	0.70	1.00
1998	1.15	1.41	0.77	0.98
1999	1.27	1.42	0.83	0.97
2000	1.26	1.71	0.83	0.97
2001	1.33	1.59	0.76	0.92

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 84: Table Showing Current Ratios Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001)

	Fruits and Vegetables		
Year	A0066	A0099	E0333
1984	0.94	0.86	1.24
1985	0.75	0.96	1.09
1986	0.55	0.82	1.12
1987	0.55	0.75	1.00
1988	0.77	0.86	1.18
1989	0.75	0.82	1.22
1990	0.77	0.84	1.19
1991	0.88	0.69	1.17
1992	1.06	0.51	1.10
1993	1.17	0.45	1.09
1994	1.05	0.56	1.17
1995	1.00	0.60	1.11
1996	0.97	0.51	1.13
1997	0.92	0.56	1.14
1998	0.92	0.46	1.09
1999	0.92	0.36	1.41
2000	0.92	0.48	1.34
2001	0.92	0.48	1.34

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 85: Table Showing Current Ratios Of Individual Co-operatives In The Grain and Oilseed and Livestock Sub-sectors (1984 – 2001)

	Grains and Oilseeds			Livestock	
Year	E0192	C0001	E0234	A0197	B0358
1984	1.16	1.34	1.47	0.85	5.18
1985	1.53	1.39	1.70	0.75	9.89
1986	1.30	1.29	1.58	0.75	4.43
1987	0.68	1.36	1.31	1.24	5.05
1988	1.13	1.42	1.27	0.99	4.93
1989	1.07	1.32	1.30	0.99	5.61
1990	0.00	1.35	1.77	0.88	6.31
1991	0.94	1.29	1.07	0.92	6.60
1992	1.02	1.57	1.08	1.02	7.06
1993	1.12	1.30	1.38	0.92	7.06
1994	1.00	1.20	1.34	1.08	7.06
1995	1.01	1.19	1.31	1.03	7.13
1996	1.07	1.24	1.26	1.01	7.34
1997	1.15	1.40	1.27	1.24	7.24
1998	1.03	1.15	1.18	0.67	8.00
1999	0.98	1.14	1.42	0.47	7.67
2000	1.00	1.17	1.16	1.17	7.83
2001	1.05	1.31	1.24	1.18	7.55

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 86: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001)

	Dairy									
Year	F0267	E0305	F0478	F0559	F1322	A0205	E0152	E0296	F1399	F1820
1984	2.20	1.24	3.55	2.67	3.00	1.24	1.70	0.85	1.51	0.37
1985	2.28	0.56	2.13	2.97	2.53	0.56	1.48	0.88	1.23	0.05
1986	2.45	0.41	1.45	0.51	1.88	0.41	1.26	0.90	0.87	0.09
1987	4.13	0.49	1.40	0.42	1.77	0.49	0.91	0.79	0.93	0.53
1988	2.99	0.56	1.54	1.73	1.68	0.56	1.02	0.65	0.85	0.20
1989	2.51	0.57	1.71	1.10	2.07	0.57	0.58	0.51	1.18	0.26
1990	0.96	1.07	1.43	1.11	2.75	1.07	0.81	0.38	1.34	0.22
1991	1.00	0.84	0.85	1.58	1.73	0.84	1.13	0.28	1.12	0.16
1992	1.17	1.29	0.74	1.76	1.71	1.29	0.92	0.34	1.13	0.20
1993	0.76	1.05	0.80	1.50	1.81	1.05	0.82	0.25	1.15	0.38
1994	0.89	0.88	0.78	1.77	1.74	0.88	0.99	0.31	1.50	0.46
1995	0.80	0.85	0.75	1.87	1.70	0.85	0.89	0.41	1.57	0.29
1996	0.85	0.69	0.69	1.66	1.77	0.69	0.77	0.37	1.66	0.85
1997	0.59	0.77	0.75	1.30	2.01	0.77	0.73	0.37	1.70	1.08
1998	0.68	0.63	0.74	0.97	1.23	0.63	0.69	0.39	1.29	1.19
1999	0.84	0.72	0.71	0.93	1.28	0.72	0.65	0.42	1.67	1.42

2000	2.01	0.82	1.52	0.61	1.45	0.82	0.62	0.50	3.42	1.66
2001	1.54	1.17	1.61	0.88	1.00	1.17	0.66	0.50	4.62	1.70

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 87: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Poultry and Egg and Honey and Maple Sub-sectors (1984 – 2001)

	Poultry and Egg		Honey and Maple	
Year	B0264	D0147	B0085	D0145
1984	1.33	1.30	2.71	3.22
1985	0.79	1.40	2.95	2.94
1986	0.83	0.98	2.53	3.32
1987	0.91	1.09	3.08	4.36
1988	1.29	2.25	3.81	4.53
1989	1.19	1.53	2.69	4.43
1990	1.43	1.59	1.69	2.64
1991	1.51	1.83	1.69	2.60
1992	1.48	1.24	1.76	3.37
1993	1.35	0.79	2.43	3.31
1994	1.57	0.79	3.02	3.65
1995	1.49	1.18	5.27	4.13
1996	1.93	1.43	2.93	3.67
1997	1.79	1.50	2.68	4.19
1998	1.91	1.65	8.29	5.09
1999	1.81	1.83	8.12	6.30
2000	2.23	1.43	4.44	6.30
2001	1.76	1.33	4.58	7.09

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 88: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001

	Fruits and Vegetables		
Year	A0066	A0099	E0333
1984	1.90	3.37	3.37
1985	4.84	3.83	6.83
1986	2.66	2.06	2.06
1987	2.53	2.15	2.15
1988	2.70	4.71	4.71
1989	2.33	5.93	5.93
1990	3.59	7.51	7.51
1991	1.99	3.89	3.89
1992	1.43	5.35	5.35
1993	1.35	3.84	3.84
1994	1.24	3.50	2.50
1995	1.02	2.50	2.50
1996	1.37	3.69	3.69
1997	1.71	5.05	5.05

1998	1.71	6.05	6.05
1999	1.71	4.41	4.41
2000	1.71	6.18	6.18
2001	1.71	4.26	4.26

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 89: Table Showing Debt-To-Equity Ratio Of Individual Co-operatives In The Grain and Oilseed and Livestock Sub-sectors (1984 – 2001)

	Grains and Oilseeds			Livestock	
Year	**E0192**	**C0001**	**E0234**	**A0197**	**B0358**
1984	1.67	1.29	0.89	6.22	0.13
1985	1.15	1.02	0.74	5.90	0.07
1986	1.05	1.29	0.83	6.44	0.06
1987	1.55	1.07	1.23	7.04	0.08
1988	2.02	0.93	1.07	7.83	0.07
1989	2.13	1.16	1.42	8.28	0.07
1990	0.00	1.12	0.77	4.66	0.05
1991	2.17	1.25	1.52	7.08	0.03
1992	2.11	0.62	1.45	6.61	0.03
1993	2.91	1.24	1.40	1.10	0.03
1994	3.66	1.49	2.15	0.87	0.03
1995	4.36	1.51	2.44	0.55	0.03
1996	4.22	1.57	2.24	0.94	0.03
1997	3.14	1.55	2.15	3.49	0.03
1998	2.20	1.28	2.11	1.70	0.03
1999	1.49	1.56	1.78	2.10	0.03
2000	1.96	1.92	2.20	1.53	0.03
2001	1.89	2.11	2.63	1.85	0.03

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 90: Table Showing Profit Margin Of Individual Co-operatives In The Dairy Sub-sector (1984 – 2001)

	Dairy									
Year	**F0267**	**E0305**	**F0478**	**F0559**	**F1322**	**A0205**	**E0152**	**E0296**	**F1399**	**F1820**
1984	0.08	0.20	0.06	0.06	0.06	0.04	0.12	0.33	0.13	0.11
1985	0.10	0.27	0.09	0.06	0.07	0.07	0.12	0.40	0.16	0.15
1986	0.12	0.29	0.11	0.19	0.09	0.06	0.14	0.37	0.18	0.20
1987	0.06	0.30	0.12	0.21	0.10	0.06	0.14	0.35	0.15	0.18
1988	0.09	0.28	0.14	0.16	0.11	0.06	0.15	0.38	0.18	0.18
1989	0.10	0.27	0.12	0.17	0.11	0.05	0.18	0.42	0.17	0.19
1990	0.19	0.19	0.11	0.19	0.06	0.01	0.19	0.46	0.16	0.21
1991	0.19	0.19	0.14	0.17	0.14	0.00	0.17	0.46	0.24	0.30
1992	0.18	0.18	0.13	0.15	0.11	0.00	0.17	0.44	0.24	0.25
1993	0.17	0.22	0.11	0.15	0.12	0.02	0.16	0.47	0.24	0.22
1994	0.17	0.24	0.13	0.13	0.12	0.03	0.14	0.47	0.24	0.23
1995	0.22	0.25	0.13	0.12	0.12	0.03	0.17	0.47	0.23	0.16

1996	0.21	0.26	0.14	0.13	0.13	0.03	0.17	0.41	0.20	0.16
1997	0.22	0.25	0.13	0.17	0.16	0.03	0.19	0.43	0.12	0.15
1998	0.28	0.27	0.14	0.16	0.49	0.04	0.22	0.41	0.19	0.17
1999	0.28	0.25	0.12	0.18	0.35	0.03	0.22	0.41	0.17	0.17
2000	0.10	0.29	0.01	0.23	0.22	0.04	0.22	0.41	0.10	0.16
2001	0.25	0.27	0.09	0.19	0.22	0.04	0.21	0.41	0.05	0.25

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 91: Table Showing Profit Margin Of Individual Co-operatives In The Poultry and Egg and Honey and Maple Sub-sectors (1984 – 2001)

	Poultry and Egg		Honey and Maple	
Year	B0264	D0147	B0085	D0145
1984	0.19	0.10	0.15	0.19
1985	0.22	0.14	0.16	0.21
1986	0.20	0.16	0.22	0.18
1987	0.21	0.15	0.23	0.22
1988	0.13	0.10	0.20	0.21
1989	0.15	0.16	0.21	0.19
1990	0.14	0.17	0.23	0.22
1991	0.13	0.14	0.21	0.21
1992	0.12	0.16	0.26	0.13
1993	0.13	0.19	0.23	0.13
1994	0.13	0.20	0.27	0.12
1995	0.12	0.14	0.13	0.08
1996	0.09	0.14	0.23	0.12
1997	0.11	0.12	0.17	0.10
1998	0.11	0.12	0.07	0.10
1999	0.11	0.16	0.09	0.08
2000	0.10	0.19	0.15	0.06
2001	0.11	0.18	0.01	0.09

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 92: Table Showing Profit Margin Of Individual Co-operatives In The Fruit and Vegetable Sub-sector (1984 – 2001)

	Fruits and Vegetables		
Year	A0066	A0099	E0333
1984	0.44	0.03	0.09
1985	0.19	0.03	0.08
1986	0.17	0.14	0.06
1987	0.17	0.12	0.05
1988	0.15	0.07	0.06
1989	0.16	0.06	0.07
1990	0.20	0.05	0.08
1991	0.22	0.09	0.07
1992	0.25	0.07	0.06
1993	0.25	0.08	0.09

1994	0.33	0.03	0.09
1995	0.31	0.03	0.07
1996	0.77	0.12	0.06
1997	0.74	0.16	0.11
1998	0.74	0.11	0.09
1999	0.74	0.12	0.11
2000	0.74	0.10	0.10
2001	0.74	0.03	0.10

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001).

Table 93: Table Showing Profit Margin of Individual Co-operatives In The Grain and Oilseed and Livestock Sub-sectors (1984 – 2001)

	Grains and Oilseeds			Livestock	
Year	**E0192**	**C0001**	**E0234**	**A0197**	**B0358**
1984	0.10	0.16	0.13	0.004	0.007
1985	0.11	0.17	0.13	0.010	0.008
1986	0.11	0.20	0.10	0.007	0.008
1987	0.11	0.18	0.12	0.002	0.010
1988	0.08	0.18	0.13	0.001	0.009
1989	0.08	0.18	0.07	0.002	0.011
1990	0.00	0.18	0.13	0.002	0.010
1991	0.08	0.18	0.11	0.006	0.009
1992	0.10	0.21	0.07	0.016	0.008
1993	0.08	0.21	0.14	0.018	0.008
1994	0.05	0.20	0.06	0.023	0.008
1995	0.04	0.16	0.07	0.023	0.008
1996	0.05	0.13	0.07	0.026	0.008
1997	0.06	0.14	0.08	0.021	0.008
1998	0.09	0.16	0.09	0.025	0.008
1999	0.11	0.17	0.09	0.047	0.008
2000	0.10	0.14	0.10	0.039	0.008
2001	0.10	0.14	0.09	0.034	0.008

Source: Computed from Canadian Co-operatives Secretariat Financial Data (1984 – 2001)

APPENDIX TO CHAPTER FIVE

Table 94: Category of Individual Dairy and Fruits and Vegetables Co-operatives based on Assets and Profits

DAIRY			FRUITS AND VEGETABLES		
CO-OP	PROFITS	GROUP	CO-OP	ASSETS	GROUP
F0267	26,890,300	Large	A0024	1,912,514	Small
F0478	18,816,966	Medium	A0066	24,164,999	Large
F0559	3,049,260	Medium	A0099	8,306,999	Large
F1322	3,542,789	Medium	E0333	8,999,111	Large
A0205	2,540,860	Small	A0175	9,530,796	Large
E0152	32,045,722	Large	B0472	1,098,269	Small
E0296	2,752,745	Small	E0397	3,689,161	Small
F1399	19,074,703	Large			
F1820	197,457	Small			
E0305	2,792,891	Small			
Large = 19,000,001 – UP			Large = 8,000,001 - UP		
Medium = 19,000,000 - 3,000,001			Small = 8,000,000 – 0		
Small = 3,000,000 – 0					

Table 95: Category of Individual Grains and Oilseeds and Livestock Co-operatives based on Assets and Profits

GRAINS AND OILSEEDS			LIVESTOCK		
CO-OP	PROFITS	GROUP	CO-OP	ASSETS	GROUP
E0192	2,637,897	Large	A0197	1,054,219	Large
C0001	456,997,235	Large	B0090	6,500	Small
E0234	2,804,087	Large	B0358	16,728	Large
E0326	279,774	Small	E0704	11,181	Small
E0406	1,801,728	Small			
Large = 2,000,001 - UP			Large = 16,001 - UP		
Small = 2,000,000 – 0			Small = 16,000 – 0		

Table 96: Category of Individual Poultry and Eggs and Honey and Maple Co-operatives based on Assets and Profits

POULTRY AND EGGS			HONEY AND MAPLE		
CO-OP	ASSETS	GROUP	CO-OP	PROFITS	GROUP
B0264	78,306,969	Large	B0085	2,273,508	Large
D0147	15,290,729	Small	D0145	1,309,085	Small
F0631	16,229,645	Small	F0121	22,727,066	Large
F0800	24,216,014	Large	F1466	47,174	Small

Large = 24,000,001 - UP	Large = 2,000,001 - UP
Small = 24,000,000 - 0	Small = 2,000,000 – 0

Derivation Of The Price Elasticities Of Input Demand

From the profit equation 3.17 in chapter three, actual profits is obtained by differentiating the behavioural profit, π^i with respect to $(k_i^i.w_i/A^i)$:

$$\partial\pi^i / \partial(k_i^i * w_i / A^i) = A^i * \exp\{ln(\pi^i)\} * \{\partial ln(\pi^i) / \partial ln(k_i^i * w_i / A^i)\} * \{\partial ln(k_i^i * w_i / A^i) / \partial(k_i^i * w_i / A^i)\}$$

$$= \{(A^i * \pi^i) / (k_i^i * w_i)\} * (b_i + \sum_j^n b_{ij} * ln(k_j^i * w_j / A^i)$$

$$; i = 1, 2, \ldots\ldots n \qquad (a.1)$$

Therefore actual profits, π^a, is given by

$$\pi_a^i = A^i * \pi^i + (1 - \sum_i^n k_i^i) * w_i * \{(A^i * \pi^i) / (k_i^i * w_i)\} * \{b_i + \sum_j^n b_{ij} * ln(k_j^i * w_j / A^i)\} \qquad (a.2)$$

Taking logarithms of (a.2), we have:

$$In\pi_a^i = In(A^i) + b_0 + \sum_i^n b_i * In(k_i^i * w_i / A^i)$$
$$+\frac{1}{2} * \sum_i^n \sum_j^n b_{ij} * In(k_i^i * w_i / A^i) * In(k_j^i * w_j / A^i)$$
$$+ In\left\{1 + \sum_i^n ((1-k_i^i)/k_i^i) * \left[b_i + \sum_j^n b_{ij} * In(k_j^i * w_j / A^i)\right]\right\}$$

(a.3)

The dependent variable in each factor demand equation is the ratio of normalized expenditure on that factor to actual normalized profits:

$$S_i = w_i * x_{ai} / \pi_a$$
$$= -[w_i / \pi_a] * [\partial \pi^i / \partial (k_i^i * w_i / A^i)]$$
$$= -\left[b_i + \sum_j^n b_{ij} * In(k_j^i * w_j / A^i)\right]$$
$$* \left\{1 + \sum_i^n ((1-k_i^i/k_i^i) * \left[b_i + \sum_j^n b_{ij} * In(k_j^i * w_j / A^i)\right]\right\}^{-1} * (k_i^i)^{-1}$$

(a.4)

Using the above equations, the estimates of the elasticities of demand can be derived.

The Own Price Elasticity of Demand for Factor *i*

$$E_{ii} = [\partial In(x_i) / \partial In(w_i)]$$
$$= b_i + \sum_j^n b_{ij} In(k_j * w_j / A) - 1 + \left\{\sum_j^n ((1-k_j)/k_j)(\sum_i^n b_{ij})\right\}$$
$$* \left\{1 + \sum_i^n ((1-k_i)/k_i) * \left[b_i + \sum_j^n b_{ij} In(k_j * w_j / A)\right]\right\}^{-1} - b_{ii} * (k_i * S_i)^{-1}$$
$$* \left\{1 + \sum_i^n ((1-k_i)/k_i) * \left[b_i + \sum_j^n b_{ij} In(k_j * w_j / A)\right]\right\}^{-1}$$
$$+ \left\{b_i + \sum_j^n b_{ij} * In(k_j * w_j / A)\right\} * \left\{\sum_j^n ((1-k_j)/k_j) * b_{ij}\right\} * (k_i * S_i)^{-1}$$
$$* \left\{1 + \sum_i^n ((1-k_i)/k_i) * \left[b_i + \sum_j^n b_{ij} * In(k_j * w_j / A)\right]\right\}^{-2}$$

(a.5)

The Elasticity Of Demand For Factor *I* With Respect To A Change In The Price Of Variable Factor *J*.

$$E_{ij} = \left[\partial ln(x_i) / \partial ln(w_j)\right]$$

$$= b_j + \sum_i^n b_{ij} * ln(k_i * w_i / A) + \left\{\sum_i^n ((1-k_i)/k_i) * b_{ij}\right\}$$
$$* \left\{1 + \sum_i^n ((1-k_i)/k_i) * \left[b_i + \sum_j^n b_{ij} * ln(k_j * w_j / A)\right]\right\}^{-1} - b_{ij} * (k_i * S_i)^{-1}$$
$$= * \left\{1 + \sum_i^n ((1-k_i)/k_i) * \left[b_i + \sum_j^n b_{ij} ln(k_j * w_j / A)\right]\right\}^{-1}$$
$$+ \left\{b_i + \sum_j^n b_{ij} * ln(k_j * w_j / A)\right\} * \left\{\sum_j^n ((1-k_j)/k_j) * b_{ij}\right\} * (k_i * S_i)^{-1}$$
$$* \left\{1 + \sum_i^n ((1-k_i)/k_i) * \left[b_i + \sum_j^n b_{ij} * ln(k_j * w_j / A)\right]\right\}^{-2}$$

(a.6)

Table 97: Input Demand Elasticity Estimates for Medium Dairy Co-operatives

[F0478 (1) F0559 (2) F1322 (3)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-1.25***	2.30***	2.85***
	(0.16)	(0.18)	(0.15)
Quantity of Capital	0.19	-0.79***	1.24***
	(0.16)	(0.13)	(0.10)
Quantity of Raw Material	-3.04***	-3.16***	-3.16***
	(0.20)	(0.21)	(0.32)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 98: Input Demand Elasticity Estimates for Large Dairy Co-operatives

[F0267 (8) E0152 (9) F1399 (10)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-0.86***	4.02***	3.68***
	(0.01)	(0.40)	(0.20)
Quantity of Capital	-0.61***	-0.53***	0.14**
	(0.01)	(0.05)	(0.06)
Quantity of Raw Material	-0.47***	0.41***	-0.70***
	(0.20)	(0.09)	(0.02)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 99: Input Demand Elasticity Estimates for Small Dairy Co-operatives

[E0296 (4) F1820 (5) E0305 (6)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-0.39***	4.97***	5.40***
	(0.03)	(0.36)	(2.55)
Quantity of Capital	-0.63***	-0.53***	15.11**
	(0.02)	(0.05)	(3.31)
Quantity of Raw Material	-0.92***	0.36***	10.84***
	(0.01)	(0.10)	(1.28)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 100: Input Demand Elasticity Estimates for Small Dairy Co-operatives

[E0296 (4) F1820 (5) A0205 (7)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-1.26***	2.65***	3.63***
	(0.29)	(0.26)	(0.31)
Quantity of Capital	-0.33***	-0.96***	1.36***
	(0.09)	(0.06)	(0.32)
Quantity of Raw Material	-2.40***	-2.21***	-1.80***
	(0.21)	(0.27)	(0.58)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 101: Input Demand Elasticity Estimates for Poultry and Eggs Co-operatives

[B0264(11) D0147 (12)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-1.79***	6.46***	6.62***
	(0.19)	(1.34)	(1.76)
Quantity of Capital	-0.93***	-14.27	2.02**
	(0.07)	(11.94)	(0.98)
Quantity of Raw Material	-2.30***	2.45	-1.49**
	(0.21)	(7.91)	(0.61)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 102: Input Demand Elasticity Estimates for Fruits and Vegetables Co-operatives

[A0066 (13) A0099 (14) E0333 (15)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-3.28***	12.17**	-3.23***
	(0.49)	(5.56)	(0.33)
Quantity of Capital	0.69***	-0.38	-0.54***
	(0.14)	(0.37)	(0.10)
Quantity of Raw Material	3.94***	3.74***	-1.70***
	(0.02)	(0.53)	(0.19)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 103: Input Demand Elasticity Estimates for Honey and Maple Co-operatives

[B0085 (16) D0145 (17)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-5.24***	6.38***	6.24***
	(0.49)	(0.49)	(0.49)
Quantity of Capital	-2.71	-0.02	6.42***
	(4.44)	(0.24)	(1.95)
Quantity of Raw Material	9.51***	9.40***	-6.24***
	(0.97)	(0.97)	(1.00)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 104: Input Demand Elasticity Estimates for Grain and Oilseed Co-operatives

[E0192 (18) C0001 (19) E0234 (20)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-10.97***	-8.93**	-10.23***
	(0.10)	(0.13)	(0.10)
Quantity of Capital	-1.34***	-2.98*	-1.64***
	(0.09)	(1.71)	(0.10)
Quantity of Raw Material	10.45***	3.92	-9.15***
	(0.12)	(3.47)	(0.13)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 105: Input Demand Elasticity Estimates for Livestock Co-operatives

[A0197 (21) B0358 (22)]

Endogenous Variables	Exogenous Variables		
	Price of Labour	Price of Capital	Price of Raw Material
Quantity of Labour	-4.10***	1.04	4.70***
	(0.30)	(2.69)	(0.28)
Quantity of Capital	-1.44***	5.30	-0.46
	(0.14)	(4.60)	(1.25)
Quantity of Raw Material	-2.90***	-2.01***	-2.27***
	(0.15)	(0.19)	(0.40)

*Note: ***, **,* denotes significance at the 1%, 5% and 10% levels respectively*
Figures in parentheses are standard deviations

Table 106: Results Of Farm Level Supply Estimations For The Various Sub-sectors.

Identifier	*Dairy*	*P & E*	*F & V*	*H &M*	*G & O*	*Livestock*
Constant	11.16	-7.41	-19.92**	3.27	2.11*	3.34***
	(14.50)	(14.43)	(9.85)	(2.98)	(1.09)	(1.23)
Time Trend	1.34	-1.30*	0.19	2.56*	1.90*	1.67*
	(1.26)	(0.75)	(0.24)	(1.52)	(1.00)	(1.01)
Farm Supply(-1)	0.81***	0.20	0.07***	0.73***	0.87**	1.04***
	(0.29)	(0.20)	(0.02)	(0.36)	(0.35)	(0.24)
Farm Price	0.62**	0.38***	0.49*	0.49*	0.80***	0.11***
	(0.31)	(0.11)	(0.25)	(0.29)	(0.29)	(0.05)
R^2	0.80	0.82	0.86	0.85	0.78	0.81
Adjusted R^2	0.77	0.78	0.80	0.81	0.70	0.74
F	15.81***	8.34***	10.50***	12.64***	17.80***	10.22***
Durbin's h	-2.49**	1.18	-3.71***	2.19**	1.78*	2.67***

where
P & E : Poultry and Egg Co-operatives
F & V : Fruit and Vegetable Co-operatives
G & O : Grain and Oilseed Co-operatives

Derivation of Producer Surplus Identity

Producer Surplus, $PS = w_i X_i - \int_0^{X_i} P(X_i)\partial X_i$

Where $P(X_i)$ = farm level supply function

Assuming that $P(X_i)$ is linear, say $c + d*X_i$,

$PS = w_i X_i - \int_0^{X_i} (c + dX)\partial X_i$

$$PS = w_i X_i - \left[cX_i + \frac{dX_i^2}{2} \right]_0^{X_i}$$

Where c and d are constants

$$\therefore PS = w_i X_i - \left[cX_i + \frac{dX_i^2}{2} \right]$$

$$\text{Max } PS = w_i X_i - \left[cX_i + \frac{dX_i^2}{2} \right] \quad \text{.....(a.7)}$$

$$\frac{\partial PS}{\partial X_i} = w_i - c - dX_i = 0$$

$$X_i = \frac{w_i - c}{d}$$

$$\therefore PS = w_i \left(\frac{w_i - c}{2} \right) - \left(c * \frac{w_i - c}{2} \right) - \left(\frac{d}{2} * (\frac{w_i - c}{d})^2 \right)$$

$$PS = (\frac{w_i^2 - cw_i}{d}) - (\frac{cw_i - c^2}{d}) - (\frac{w_i^2 - 2w_i c + c^2}{2d})$$

$$PS = \frac{2(w_i^2 - cw_i) - 2(w_i c - c^2) - (w_i^2 - 2w_i c + c^2)}{2d}$$

$$PS = \frac{2w_i^2 - 2w_i c - 2w_i c + 2c^2 - w_i^2 + 2w_i c - c^2}{2d}$$

$$PS = \frac{w_i^2 + c^2 - 2w_i c}{2d}$$

$$PS = \frac{1}{2d} w_i^2 - \frac{c}{d} w_i + \frac{c^2}{2d} \quad \text{(a.8)}$$

Note: c and d are obtained from estimating the farm supply equation.

The second degree Taylor series expansion of PS as a function of w_i is given as follows;

$$PS = \beta_0 + \beta_1 * w_1 + \beta_2 * w_2 + \beta_3 * w_3 + \frac{1}{2}\beta_{11} * w_1^2 + \frac{1}{2}\beta_{22} * w_2^2 + \frac{1}{2}\beta_{33} * w_3^2$$
$$+ \beta_{12} * w_1 * w_2 + \beta_{13} * w_1 * w_3 + \beta_{23} * w_2 * w_3$$

$$PS = \left(\frac{c^2}{2d}\right) - \frac{c}{d}\beta_1 * PL - \frac{c}{d}\beta_2 * PC - \frac{c}{d}\beta_3 * PR$$
$$+ \frac{1}{2d} * \frac{1}{2}\beta_{11} * PL^2 + \frac{1}{2d} * \frac{1}{2}\beta_{22} * PC^2 + \frac{1}{2d} * \frac{1}{2}\beta_{33} * PR^2$$
$$+ \frac{1}{2d}\beta_{12} * PL * PC + \frac{1}{2d}\beta_{13} * PL * PR$$
$$+ \frac{1}{2d}\beta_{23} * PC * PR$$

Taking logarithm of both sides of the equation, we get:

$$InPS = \left(\frac{c^2}{2d}\right) - \frac{c}{d}\beta_1 * InPL - \frac{c}{d}\beta_2 * InPC - \frac{c}{d}\beta_3 * InPR$$
$$+ \frac{1}{4d}\beta_{11} * InPL * InPL + \frac{1}{4d}\beta_{22} * InPC * InPC$$
$$+ \frac{1}{4d}\beta_{33} * InPR * InPR + \frac{1}{2d}\beta_{12} * InPL * InPC$$
$$+ \frac{1}{2d}\beta_{13} * InPL * InPR + \frac{1}{2d}\beta_{23} * InPC * InPR \qquad (3.28)$$